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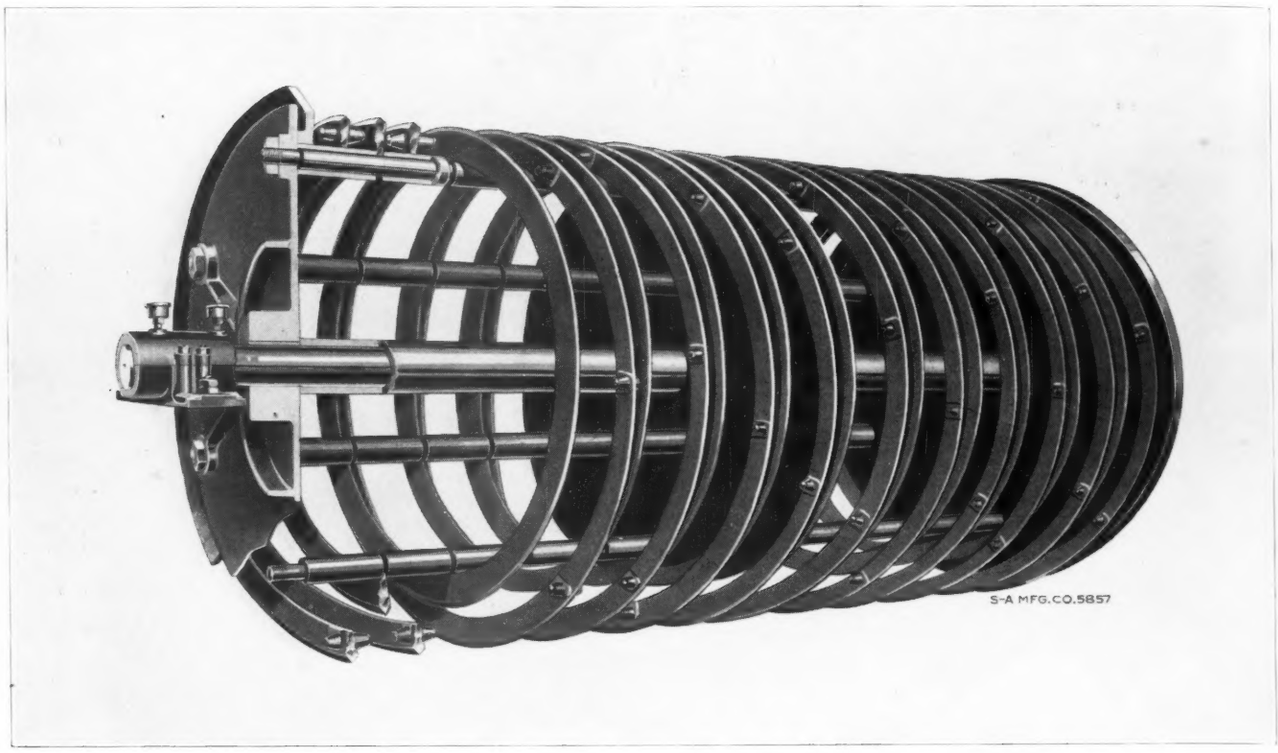
A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

April 28, 1923



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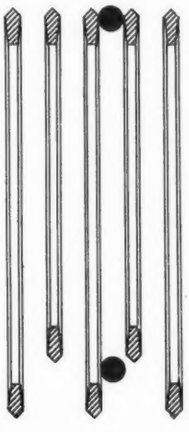

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BURCH *Grizzly*

ENGINEERING & MINING
JOURNAL-PRESS
JOSIAH EDWARD SPURR, Editor

Volume 115 New York, April 28, 1923 *Number* 17

Burning the Candle at Both Ends

THE *Literary Digest* writes us inquiring as to the possible exhaustion of the mineral supplies of the United States. Its interest has been aroused by a remark made by Sir Mackay Edgar, after a recent visit to this country, to the effect that the most conspicuous phenomenon here was the extreme rapidity with which we were drawing on our natural resources; and he remarked with entire cheerfulness that all England had to do was to wait until we had exhausted our supplies, when England would sell us what we needed at her own prices. "Is it true," asks, in effect, *The Literary Digest*, "that we are thus consuming our natural fortune at a profligate's pace; and, if so, shouldn't something be done about it; and, if so, what?" Sir Mackay Edgar's remark, so far as it referred to our phenomenally rapid consumption of our supplies, is true; but his inference was not intelligent. He forgot that England has long been stripped of the supplies of which we are rapidly divesting ourselves, yet continues to maintain her position by developing the rest of the world. That is precisely what America is already beginning to do on a large scale.

Mineral supplies have been by fortune allotted to our territory in great abundance. American energy and skill has depleted them at a rate so far in advance of anything else ever known that it is among the wonders of a wondrous age. Consumption increases in an ever-steepening curve; and extraction of metals from the earth accompanies apace. Luckily, of coal and iron we have such an enormous store that we need have no immediate concern as to exhaustion; with coal, our immediate and pressing problem is simply that of distribution. "Is there waste in production," asks *The Literary Digest*, "and what means may be taken to reduce or eliminate it?" Waste is something that needs to be defined. We may be letting copper or silver go into the mill tailing, but if we cannot save it profitably, is it waste? We think not. Therefore we believe this to be an economic problem which takes care of itself. Technical and business skill are constantly on the alert to make savings, to secure the last pound or ounce of metal which can be saved profitably.

The problem of conservation is an important one, especially as applied to mineral supplies, which is our own particular business. We fail to see how law or other government guidance can affect it directly, although it can and should indirectly. The conservation of forests affords no helpful parallel. After all, forests grow; but minerals do not, in the human-period sense. Reforestation is possible, but not remineralization. Moreover, the scheme of government forest reservation was an unpopular and probably an ill-advised one. Certainly it did not strike at the root of the matter. We should not advise government mineral reserves. We advise every help to mining everywhere; never any hindrance. How, then, shall we be thrifty, in a national sense? By adopting such national measures that our use of the world's mineral supplies shall also be facilitated rather than hampered. In that principle lies the solution in a nutshell.

Depth and Speed of Oxidation

OXIDATION AND DISINTEGRATION of ores and rocks, through the agency of waters descending from the surface, proceeds on the average with extreme slowness. In most places there has been little post-glacial oxidation in heavily glaciated areas, as in New England and Canada. Here, in most instances, the primary sulphides of orebodies almost or quite outcrop at the surface. Since the great continental glacial cap which covered most of the northern part of North America disappeared over fifty thousand years ago, it may easily be realized what an immense lapse of time is necessary to produce completely oxidized zones extending downward several hundred feet from the surface, such as we find in many places in the arid regions and in the more southerly states of the United States, for example. We must grant a period of oxidation extending over several millions of years, in many instances. Cases have been reported where oxidation appears to have proceeded much more rapidly, but in the light of the above general considerations, we conclude that these cases were under very exceptional circumstances, or, indeed, that the basis from which the deductions were made has been mistakenly assumed.

Once a deep zone of oxidation is formed, it may last for immense periods. It may, to be sure, be carved off by rapid erosion, of which the most spectacular case is the giant planing of glacial action above referred to. That the word planing is an apt one is shown by the deep grooves and polished rock surfaces which have been left from the overriding of the ice and frozen-in rock fragments. An upheaval of the land, making highlands out of lowlands, may also produce such rapid washing away by rains and streams that the slowly formed zone of oxidation is worn rapidly down and carried away by the swift and muddy waters. On the other hand, if a deeply oxidized region be lowered instead of uplifted, it may become the site of rapid sedimentation—the accumulation of mud or sand or gravel in water or upon lowland areas—and in this case the deep oxidized zone may be covered up, and protected and preserved indefinitely. Certain deep oxidized zones which are of this kind—some, for example, in Arizona and in the Lake Superior region—are of pre-Cambrian age, and were covered up by Cambrian and subsequent sediments, and so preserved for the mining operations of the present day, with little noticeable change of characteristics. These are fossil oxidized zones.

In areas where the oxidized zone has been scoured off, it is proper to add, the gouging action has been of unequal intensity, so that while the tool of the glacier, for example, may have in some places bit far down

below the oxidized zone, in other cases it may have spared part of the ancient oxidized accumulation.

Climate and rainfall, of course, have much to do with intensity and the depth of oxidation. In warm wet climates, it is most rapid and complete: in warm dry climates, deep but irregular and incomplete.

Americans and Turkish Petroleum

THE LONG DIPLOMATIC CONTEST between France and England for the petroleum of the Mosul area in the upper Euphrates region, to which we have referred from time to time during the last few years, and which has been one of the dominating though underlying factors in various conferences, from Rapallo to Lausanne, became further complicated when Turkey by force of arms established her right to be recognized and dealt with politely. Upon this happening, Turkey herself protested against the tapping from her ancient territories of the Mosul petroleum, and this obstinate wish was one of the reasons why the Lausanne conference broke up, although even the American representative advised her to yield. Now Turkey has cleverly drawn a new element into the situation by ratifying the Chester concession, which gives an American syndicate the right to develop petroleum in this region, and cancels an earlier permission secured by France. The move was clearly political on Turkey's part, for the Chester concession is an ancient one, dating back to Abdul Hamid; and this concession, granted to former Admiral Chester, of the United States Navy, it has been vainly sought for many years to have successive Turkish parliaments ratify. Word comes from our State Department that it will support the rights of the Chester concession, which is natural in view of the wide-awake policy of our State Department as regards to the exploitation of foreign oil by Americans; and in view of the high character of those financially interested in the concession. Thus, diplomatically, the Turks have played a trump card. Turkey has been endeavoring to draw America into the Near East question ever since the war; and the Allies, especially England and France, also endeavored to secure this result earlier, but the present form of commercial competition is of course not to their liking.

Opportunity Knocking, or Knocking Opportunity?

ONE OF OUR British Columbia friends has sent us a circular emanating from one Matt Baumgartner, of the First National Silver Mines, Ltd., Spokane, Wash., with the idea, probably, that we should not overlook anything important, in a mining way, that is going on in our own country.

We have never heard of the First National Silver Mines, Ltd., and the circular says nothing about their situation, but we must ACT NOW—there is no time to investigate. Who could resist the opening appeal of Mr. Baumgartner's letter: "If you have ambition to get a larger share of life's good things, and if you want a dividend check in the near future"? So far we jog along with the writer. But here we break, for he goes on to say "you will certainly not fail to grasp the LAST OPPORTUNITY to purchase First National shares at ONE CENT PER SHARE." This seems fair enough though, after all, for they could not well be sold for less without competing with Russian rubles and German marks. But Mr. Baumgartner says, "In fact this may be your very last opportunity to get these shares at all." We hardly like to invest in shares whose future market is so uncertain. We prefer to invest in something that will have a market after we get it. Reading further, "THERE ARE ONLY ONE HUNDRED THOUSAND SHARES AT THAT PRICE. The price of these shares will POSITIVELY BE ADVANCED TO FIVE CENTS PER SHARE, OR MAY BE ENTIRELY WITHDRAWN FROM THE MARKET." That last alternative is just what we do not like. Without this possibility we would simply buy at 1c., sell at 5c., and make a neat profit of 400 per cent on the transaction. But there are only 100,000 shares available—an investment of $1,000 would clean up the market, and it is hardly likely that even if we telegraphed immediately we could get the whole supply, for some other suckers are no doubt ahead of us.

"With the First National property already fully equipped for its present needs"—that is, we take it, a supply of literature, envelopes, and postage stamps—"the vein already opened up to a great extent, eighty per cent of the development work completed, it makes the shares of the First National as safe and sound as any mining investment could be hoped for. *All we are after now is the high-grade ore and we know where to look for it.*" As editors say, the italics are ours. How true that statement is and of what general application to young mining companies!

A. R. O.

PROBABLY the most widely known man in the Northern Shan States of Upper Burma is a lank American who is known simply by his initials, A. R. O., to Europeans and natives alike, though the latter use the word Sahib in speaking to him, and of him to another white man. From Mandalay eastward well into Yunnan, the frontier province of China, his tall slim figure, bare-kneed, clad in the characteristic "shorts" of the tropics, is familiar. He works for the Burma Mines, Ltd., whose operations have been described by Mr. R. G. Hall in a series of articles that end with this issue. Just at present he is called general superintendent, but his title is a matter of small consequence. He is in many respects the most valuable man now in the employ of the company—or who has ever been in the employ of the company; this we say with all due respect to many competent men who have served as his superiors.

Resident managers have come and gone, but A. R. O., with the exception of one trip to London, has been on the job for seventeen years. He has been resident manager, himself; he has been smelter manager and railroad manager; he has been assistant to the resident manager, various kinds of superintendent, and chief of the exploration department; but whatever has been his particular job, the current resident manager has valued him more highly than his own right hand. A. R. O. has in his make-up something of the empire builder—he is not a Cecil Rhodes, but he has many of the characteristics of a Rhodes. Seventeen years ago he left the A. S. & R. smelter at Murray, Utah, where his parents still live, to go to Burma. With one other white man he constructed the 47-mile narrow-gage railroad that connects the Bawdwin slag dumps with the main line of the Burma railways. Only those who know a tropical jungle in a rough country can realize the diffi-

culty of the undertaking, and even they may not appreciate the added difficulty of working in a strange country with next-to-useless native labor. Then he built the smelter at Mandalay, and taught Shans and Chinamen to run it. He moved the smelter to Namtu, 13 miles from the mine, and ran it there for several years. Gradually more Europeans joined the staff, but A. R. O. was the dean. He it was who scoured the jungle for iron mines and limestone quarries; who made repeated incursions into Yunnan and established diplomatic relations with the native headmen, so that needed coolies could be brought to the mines; who found the falls on the Mamsan River where the hydro-electric plant is now situated. Whenever a job came up that no one else could tackle, A. R. O. was called upon. He knows enough of half a dozen heathen dialects to communicate with the natives. He can shake off a "go" of malaria, or proceed about his business in spite of one, with the ease of a native. He can subsist on native diet and questionable water as few white men can. He is tactful and diplomatic; he enjoys the confidence of the natives, and, as we said at the outset, he is more widely known than anyone else in the country. Therein lies his peculiar value to Burma Mines, Ltd.

A. R. O. has a large plantation about three miles from Namtu, where he raises livestock and produce for supplying the community with meat and milk, and all kinds of fruit and vegetables. Incidentally, his bungalow and farm are the scene of many social gatherings, for more than 125 Europeans, men and women, are now living at Namtu, and a more hospitable host is not to be found. Visitors ask A. R. O. if he ever expects to go back to the States. He says he hopes to, some time; but adds that the first fifty years in Burma will no doubt be the worst.

Much has been written about the famous silver-lead mines, but mention is seldom made of individuals. To A. R. O., the one man who has devoted the best part of his life to the development of the enterprise, this little tribute is ungrudgingly paid.

Difficulty in Obtaining Government Publications

A CALIFORNIA SUBSCRIBER complains to us that he is unable to secure from Washington many of the government bulletins that he finds mentioned in the *Journal-Press* and other papers. Specifically, he wrote to the U. S. Geological Survey for Bulletin 735-H, which, according to our Feb. 10 issue, could be obtained from the Survey on request, mentioning when he wrote that it was descriptive of the peridotite dikes of Scott County, Ark. In return he was sent a card saying that the bulletin was out of print and not obtainable from any official source.

We do not know just what proportion of government publications are unobtainable within, say, six months after their publication, but if it is at all large, steps should certainly be taken to remedy the condition. The investigations covered by these reports cost too much money to have publication of the results restricted. Possibly the Survey can throw light on the situation.

Ordinarily, a certain number of copies of a new report or bulletin are retained by the bureau or department issuing it, for free distribution to interested persons, as mentioned from time to time in our "Technical Papers" column. The balance of the edition goes to the Government Printing Office for sale at a nominal price to cover the cost of printing and mailing. Very often, therefore, if a document cannot be obtained from the department, it can be obtained by writing to the Superintendent of Documents, Washington, D. C., though a small price will then have to be paid. In the instance cited by our reader, however, it seems that the desired bulletin could not be obtained from any source, although issued only a little over two months before the inquiry was made.

The above editorial paragraph was written some little time ago, but since we felt we did not have the whole story, it was submitted to the Director of the Geological Survey for comment before publication. His comment is as follows:

"The plaint from your California subscriber that many Geological Survey reports are not obtainable is unfortunately only one of many of the same kind that have come to my attention. It reflects a condition which cannot be remedied so long as funds for the publication of the Geological Survey reports are not adequate to print the results of its investigations. Palliative measures have been adopted by scrutinizing closely the reports submitted for publication and drastically eliminating all but the most essential material, by placing certain data in open files instead of printing them, by dispensing with covers on many classes of publications, by acquiring copies not needed by the possessor. Still, after practicing all the real economies suggested, the estimated cost of the reports scheduled to be printed exceeds the money available. Under these conditions, and with considerable reluctance, it has been necessary to go even further and cut down on the size of the editions. Some defense of this policy is offered by the fact that a copy of each Survey report is sent to nearly a thousand of the leading libraries, so that the information they contain can be obtained, at some trouble and expense, it is true, whereas unpublished material is not available in any form. Sound policy, therefore, has compelled the Geological Survey to meet the situation by adopting the lesser of two evils and reducing the size of editions and limiting the distribution."

The fact is, as we have ascertained, that it is really a matter of funds. The demand for Survey reports, and consequently the number of reports put out, has constantly increased. On the other hand, for the years 1903 to 1906 the appropriation for printing was $215,000 per year; from 1907 to 1918, an average of $175,000 per year; but for 1919, $100,000; for 1920, $125,000; for 1921, $150,000; for 1922, $140,000; and for 1923, $127,000. When we consider the increased cost of printing over say 1905, we perceive that the appropriation for 1923 amounts to about one-third that for the year in question. There are more manuscripts on hand than can possibly be printed with the funds in hand. After all thinkable economies have been made in reducing the bulk of the reports, and in the printing, it has still become necessary to pare to the dangerous limit the size of the editions. In one case the publication of an important report was approved by the Congressional Committee for publication only with the provision that the edition be limited to a certain number, which after providing for the regular allotments, left only 250 copies available, of which 125 were required for the Survey's official files.

Other economies and remedial measures may be possible, but clearly they are not within the power of the Geological Survey. The only remedy would be an increased appropriation for printing: and the only real "kick" a citizen has, if he cannot get a Geological Survey bulletin, is to his Congressman who has allotted the funds. Otherwise, he must console himself in the nearest library, if there is a nearest one.

DISCUSSION

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

A National Precious-Metals Association

THE EDITOR:

Sir—I have been following discussion and agitation of the Nicholson bill with great interest and believe that gold and silver mining is eventually to be encouraged by some special legislation. It occurred to me on reading the editorial in *Engineering and Mining Journal-Press* of March 17, "Help From the Government," that the keynote of our present conditions in gold and silver mining has been struck—namely, lack of voting power and numerical strength of the mining industry. A nation-wide "Precious-Metals Association," including eastern stockholders as well as western producers and miners, is still lacking. I am personally convinced that until a numerically strong organization is established, our progress will be exceedingly slow, or just about at the rate of the famous pilgrim to the shrine at Lourdes, France, which consists of two steps forward and one backward.

As an effective organization along the line suggested seems at present out of reach, I wish to suggest a campaign to utilize the so-called "Farm Bloc" or other similarly powerful entrenched and established voting bodies for our purposes. It seems to me of prime importance to distribute literature among the farmers, in simple form, stating that with overproduction in the United States of farm products and the inflation of the European paper or fiat money, gold will have to be shipped to Europe before Europe can buy from us. It should be also mentioned that it is an established economic fact that one dollar in gold creates approximately twenty dollars in credit, and that any legislative action, direct or indirect, which will increase the gold production from $50,000,000 to $100,000,000 or establish an additional credit of $1,000,000,000, at the cost of, say, $25,000,000 to the taxpayers, is a good business proposition from any viewpoint.

Without going into statistical acrobatics, it should be mentioned in the plainest of language that unless the production of gold and silver is stimulated in this country no gold can be shipped to Europe, assisting in the deflation, and for this reason the surplus farm production cannot be marketed and the farm conditions will remain in a state of stagnation.

The average voter in this as in every other country is the plain citizen and should be reached in a manner which he can understand. High-class oratory and complex statistical data are splendid in their places, similar to higher mathematics with the trained physicist, but plain arithmetic counts with the man on the street, the farmer, and the great mass of the less prosperous, constituting in the aggregate the voting power of the country.

A. T. ROOS.

Deadwood, S. D.

The Overestimation of Geological Skill

THE EDITOR:

Sir—Your editorial of March 24, 1923, on "The Overestimation of Geological Skill," has caused much adverse comment in Ontario. Dealing as it does with the reputation of an individual, it is without point and unfair unless the name of the individual is known, and this your readers are left to guess. Most persons conversant with mining in northern Ontario have not hesitated to connect the name of a prominent geologist with your editorial, and feel that he has a good defense and is deprived of his right to reply. In any case several names will be connected with the editorial, and it is mischievous in that it involves the reputations of as many men as there are different guesses.

Such a trained geologist as the Editor of the *Journal-Press* will hardly, after mature consideration, propose to judge the scientific attainments of a fellow geologist on a few chance phrases of his friends—perhaps laymen. Should he not be judged on his own written and verbal statements?

Most of the structural geology of Cobalt was worked out in the early days by Dr. Willet G. Miller, and his work furnished a firm basis on which the later exploration and development of the northern Ontario silver field has been based. For some years geologists and mining engineers have been fighting upward out of the mire of "luck, pluck, and common sense" into which the wildcat salesmen would consign our profession, together with the mining business. It would be idle to deny that luck, pluck, and common sense have had much to do with the uncovering of practically every new mine, but it seems too bad that a full measure of praise should be denied where geological skill has been successfully used in such a venture, and denied especially by those who should be its champions. I hold no brief for the man who may be referred to, and the opinion of those who know him will not be altered by this editorial, but I do feel that the mining profession needs all the support it can get to counteract the layman's common opinion that the intelligent application of scientific principles plays only a very small part in achieving success. Such an editorial as this hurts the profession more than it does the individual. In so far as the foregoing is true, the editorial falls below the standard set by the *Journal-Press* in the past.

The statement that "such rich ores (in Cobalt) have no stated relationship to the surface," while true in itself, is only half the truth. It is now universally accepted that the locus of the ore zone in the northern Ontario silver deposits is at or near the contact between the Keewatin and either the upper or the lower surface of the Nipissing diabase or the Cobalt conglomerate. If the distance of the contact from the surface is determined either from structural data, diamond drilling, or sinking, then the locus of the ore zone has a stated relation to the surface. The "depth of enrichment," used in its ordinary geological sense, has no meaning in Cobalt, as there is no pre-glacial weathering in the

Cobalt area, but if the depth of the contact is known, the depth of the locus of the ore zone may be calculated. So certain is this, that the accepted mode of procedure in exploring for silver deposits in northern Ontario is to locate the before-mentioned contacts and then explore these contacts for ore.

While it is true that pre-glacial weathering and secondary enrichment do not exist in Cobalt, and only slightly in that part of Canada within the area of continental glaciations, still there are notable exceptions, such as at the Helen iron mine, where weathering extends to a depth of over 500 ft., and at the Eldorado copper mine, in Hastings County, where it extends to a depth of 60 to 80 ft. In the northern Ontario silver fields one notable exception is the Wood's vein on the Keeley mine, in South Lorrain Township. The Ontario Government geologists have now determined that in this vein pre-glacial weathering does exist to a depth of at least 480 ft., and that part of the silver in the rich oreshoots which are found near the contact between the Keewatin and the diabase is secondary. However, it remains to be determined just what proportion of the silver is primary and what part is secondary. The recently discovered deposits in South Lorrain are, in this respect, distinctly different from those in Cobalt.

It would seem that the comparative rareness in Canada of orebodies in the formation of which pre-glacial weathering and secondary enrichment have played a part adds to the reputation of anyone who has recognized their presence where they might be presumed to be absent, and who has used these indications with other structural locations to locate an orebody.

Since the Editor has left his readers to guess the identity of the subject of the editorial, I may be pardoned if I hazard a guess that the Editor-in-Chief of the *Journal-Press* did not write this editorial, or at least drew his information from someone not thoroughly in touch with the geology of recent developments in northern Ontario, or perhaps from a layman.

Toronto, Ont. WALTER E. SEGSWORTH.

Institute Affairs

THE EDITOR:

Sir—The manner in which D. H. Fairchild handles the affairs of the American Institute of Mining and Metallurgical Engineers in your issue of April 7 completely harmonizes with my views. The publication of *Mining and Metallurgy* should be discontinued at once and save the Institute funds. The dues could then be placed on the former $10 per year basis. I do not recollect having voted for or against the increased dues.

The nominating committee of the Institute is another matter which requires special attention. The general plan is to send out a ballot with the name of one aspirant opposite each office to be filled, and ask the members to vote it. Why waste postage stamps? It is evident that the privilege of a "choice" is denied the Institute membership in voting. Whether the source of this denial is the nominating committee or the "higher-ups" is a matter of conjecture.

I have been a member since 1912 and have paid my dues promptly each year, except for 1923, which are held back as a form of protest. I shall be glad to share in the expense of twenty-five or fifty members, to meet at some central point and take steps to sound out the membership on what action they want on such questions.

Duluth, Minn. A. C. OBERG.

Absentee Landlordism

THE EDITOR:

Sir—Critics of our present industrial system are prone to cloak their dissatisfaction with generalizations, which, like the two kinds of dresses, either cover everything without touching anything, or touch everything, without covering anything. One of the favorites seems to be "absentee landlordism." From its very nature, the mining industry is the frequent lay figure on which is hung this "creation." Like many such it is not designed for the every-day use of life, but is intended to attract attention on gala occasions. Then time is lacking in which to dissect its parts, and disclose the skill and imagination of the designer, who has thrilled us with a phrase, which, if not "soul-filling" is at least "a mouthful."

By the term "landlordism," I presume is meant "ownership." "Ownership" to be anything but "absentee" would require every man who owned one share of stock in any corporation to be a resident of that community in which the corporation conducts its business. It is easy to see where this would lead to, in the case of a corporation which conducted business in more than one community, or what would happen to the man who was unfortunate enough to own shares in several such corporations. Obviously, this cannot be the solution sincerely desired by the self-appointed spokesmen of the "downtrodden," who, if the truth were known, are often the hopeful owners of many beautiful engravings. Alas! Too seldom do these holders of promising certificates succeed in landing in the "hallowed circle" of the "absentee landlords."

Where does the kernel of truth lie, in this vexing question? My experience, in dealing with the men who work in mines, has, strangely enough, confirmed my conviction that men are men, and that aside from the realms of pathology, the same instincts and ambitions actuate us all. This holds no matter what our station in life, inherited or achieved. A most artistic and convincing exposition of this "bromide" is now playing in New York under the title of "Seventh Heaven." The hero, who is a worker in the sewers of Paris, feels that if only he might become a street washer and handle the hose, his private conviction that he is "a very remarkable feller," would gain public recognition. When our public recognition is thwarted through the fault of ourselves or others, we suffer from an "inferiority complex." Inasmuch as the phrase smacks of geology, it should be studied by our profession, and used to describe certain phenomena, with which we are all familiar, but whose place in the social hypothesis we have failed to identify. Such study might enable us to foresee and avoid human mistakes at least as skillfully as we do those of technical judgment. Mistakes in handling human relations are even more costly than those involving matter alone. Here, too, the scientific or truthful attitude of mind plus tact will prevail.

No normal human being wants something for nothing. What we do want, is the feeling of lasting satisfaction which comes from work well done and its appreciation by those around us who, we secretly admit, are a little higher on the social ladder than ourselves. Here lies the weakness of the labor movement as presently directed—its denial of the infinite gradations in human ability, and its attempts to establish by proclamation the fallacy that all men are created equal, more especially all miners, machinists, blacksmiths, boiler-makers,

carpenters and other toilers. Everyone knows in his heart of hearts that this is nothing more than pure American "bunk." What is really needed is to demonstrate by our direction of industry that all men shall have equal opportunity to develop their ability, and have it adequately recognized and rewarded.

Perhaps what lies at the basis of the opprobrious term "absentee landlordism" is the feeling that the people whose good opinion we desire most of all, those for whom we are working, are unable to be physically present and personally observe what "remarkable fellers we are" after all.

Somehow or other, it seems to take more intelligence to keep friendly relations with our associates than it does to solve our technical problems.

New York. ARTHUR NOTMAN.

Manganese Deposits in Nova Scotia

THE EDITOR:

Sir—I have, with much interest, read Frederick C. Fearing's article in your issue of Jan. 6 last, on the "Manganese Deposits of Lunenburg County, Nova Scotia," as well as discussion on the same by Mr. Reid and Mr. Fearing. All has been much appreciated, but I doubt if the authors have ever had a full opportunity to study in detail the manganese deposits of Nova Scotia, and for this reason I offer my mite.

I first want to make it clear that the Lunenburg manganese deposits are not the most important in Nova Scotia, nor are they characteristic, but the exception to the general formation of these occurrences. The true deposits of this mineral throughout the Maritime Provinces occur in the marine limestone, of the lower Carboniferous measures. This belt or zone, of varying thickness, extends, in Hants County, from its western extremity in a tortuous course to its eastern boundary without interruption, and continues beyond for many miles with many outcrops of high-grade ore. The ore taken collectively could well be classed as chemical ore, with iron content not exceeding 1 per cent, and other impurities brought down to a minimum. Average samples of shipments from deposits in this zone have shown by analyses well above 90 per cent and selected samples as high as 98 per cent of manganese dioxide. This limestone lies on the Devonian measures and may be subdivided, in ascending order, as follows: (It will be noted that the ore in each subdivision occurs in a different form and is quite distinct from that in any other subdivision).

1. Sedimentary laminated limestone having a thickness of 15 ft. This is not important as an ore producer, but at some isolated points the whole belt will yield from 10 to 15 per cent pyrolusite. The ore here has been deposited in what might well be termed sun-cracks. The small veins, seldom exceeding 1½ in. in thickness, run in all directions, dipping at right angles to the stratification.

2. Next in order is a massive marine limestone; in color light reddish gray, and known to the miner as the "white rock," on account of the color, which is much lighter than that of the other subdivisions. In this, the ore occurs in lenticular veins, having a regular dip and strike, varying in thickness, sometimes pinching out to a mere nothing, but always leaving an indication—as far as any depth yet mined—to follow. These veins, as a rule, dip in the opposite direction to the stratum in which they occur, generally at a high angle, and they also have a deepening inclination on the strike.

3. Overlying this subdivision is what is known in the parlance of the miner as the "soft rock," a brecciated limestone, the fragments of which are evidently from the underlying subdivision. It is much softer than the massive subdivision, and in color is dark brown. In this the ore occurs exclusively in pockets, from the smallest up to the largest, so far taken out, of 1,000 tons. Unlike the occurrence in the massive rock, when these pockets are extracted they leave no indication of which direction to drive to find another.

In the above I have given a cross-section of the famous old Tennycape mine, which has not been operated for many years, but which is by no means exhausted. It is a characteristic of the occurrence of manganese ore in Nova Scotia. It is true, a few more or less important deposits of manganese do occur in the Devonian and other older measures of Nova Scotia—Lunenburg being the most important—yet, as a whole, the older rocks as producers are not considered of economic importance.

The genesis of these ores seems simple. The laws that govern the deposition of limonite are applicable to the deposition of manganese:

1. The ore was originally derived from the older (possibly the pre-Cambrian) rocks by disintegration, and by moving waters or wave action has been liberated from the lighter minerals and deposited in depressions in the surface of the lands, known as marshes or bogs, in the form of wad or bog manganese. Large areas of this variety of ore, some of great purity, are now to be seen in the Maritime Provinces.

2. A secondary action has taken place through the agency of meteoric or surface waters, and this already purified ore was precipitated in the crevices, fissures, caverns, or water-courses and crystallized in the form in which it is found today. Owing to the difference in the specific gravity between this ore and limonite—the principal ore associated with manganese—if iron was present at the time of final deposition it was precipitated at the top of the vein. This is illustrated in the mining of the lenticular veins above described. If one of the shoots or veins of ore was cut at a depth, and if, in stoping it out toward the surface, nodules of limonite were encountered, experience has taught us it is time to stop, as we are at the top end of the vein.

3. The ore ends not at the present water level but at a point beyond which it had no further course, at the time the deposition was taking place, to continue. The fact that a fissure or lens of ore has pinched out of itself is not conclusive evidence that ore does not exist at a greater depth, providing the crevice or water-course in which it has been deposited continues.

4. There is every evidence that the vein filling was due to the surface waters, but whether these waters traveled laterally or in any other direction depends entirely on the position of the rocks and water-courses at the time the deposition took place. That the strata since the period of deposition have been tilted, folded, and faulted is a point which I think Mr. Fearing has not given full consideration.

5. It is quite true that much of the oxidation in Nova Scotia was pre-glacial, but just what effect it had on the genesis of the manganese deposits is problematic. I am inclined to concur in the theory of post-glacial deposition. However, this is immaterial and a story of itself. W. F. JENNISON.

Boston, Mass.

The Burma Enterprise

By T. A. Rickard

AT INTERVALS the reviewer of mining affairs turns to an enterprise that repeatedly seems about to go forward to fruition and as frequently is found to have halted in its progress on account of a new difficulty or the cumulative effect of old difficulties. The Bawdwin silver-lead-zinc mine, in the Northern Shan States, was worked by the Chinese before Columbus landed in the West Indies. Modern exploitation started in 1904, but not until 1906 was a systematic effort made, and even that was applied only to the smelting of the slag. These attempts to make money from the smelting of the old slag proved disappointing on account of difficulties of transport, represented by a badly constructed railroad over a rough country. This is made clear by Mr. R. G. Hall's article, one of an interesting series, appearing on another page. Mr. Hall, who was resident manager of the property recently, writes feelingly, because he had to face the obstacles so vividly described.

In 1910 the reopening of the mines was started, and within the following three years a large reserve of ore was uncovered. Yet the enterprise languished; it yielded no dividends. In 1913 Mr. Herbert Hoover reorganized the company, known as the Burma Corporation, and under his leadership an earnest effort was made to put it on its feet. By the end of 1915 it is estimated that $10,000,000 had been spent on the property and over a million tons of high-grade ore had been developed. Unfortunately even Mr. Hoover found it difficult to obtain consistent support from the principal shareholders, most of whom had a far better understanding of stock-jobbery than of the art of mining. When Mr. Hoover was called upon to give his great abilities to the service of mankind, during the war, he resigned first as chairman in 1916 and then as director in 1918. He ceased also to be a shareholder, having good reason to anticipate that the value of his holdings would depreciate. The stock market valuation of the Burma Corporation declined from $70,000,000 to $17,500,000. Since Mr. Hoover's retirement the enterprise has drifted upon the shoals of mismanagement, not so much in technical affairs at the mine and smelter, but because of the shifting policy, the weak finance, and the personal squabbles of those at the head of the company in London. More than $15,000,000 has been spent, but no dividend has been paid as yet, or is any in sight. Lately the services of a distinguished metallurgist, Mr. E. P. Mathewson, have been requisitioned, and he has made a report in which much good advice is given, but it is extremely doubtful whether bushels of good advice will prove effective so long as those at the wheel keep their eyes on the ticker and the tape. At the present rate of production the earnings are inadequate to place the business on a sound financial basis.

The lack of a consistently intelligent policy is due largely to divided counsels in London and the fact that the interest of the principal shareholder, Mr. R. Tilden Smith, has stood in the way of the welfare of the enterprise. During the war Mr. Smith hypothecated his Burma stock at a high figure, from which it fell so far as to leave him no equity in it; he had to do this in order to nourish his war babies—a number of lead-smelting plants that he took from the Metallgesellschaft and other German interests confiscated by the government. These he consolidated into a company known as the Lead Manufacturers' Association, which then, on his initiative, made a contract with the Burma Corporation to give the Association the smelting of the lead concentrate in excess of the capacity of the Namtu smelter—then only 400 tons daily. That arrangement crippled the Burma Corporation in advance. It had spent a million dollars on an acid-making and zinc-smelting plant in India, and it had a contract with the Tata steel works for the entire output of acid and spelter for fifteen years. The change of plans and cancellation of that contract again tied the Burma Corporation and checked its logical development.

Mr. Smith had an unprofitable zinc smelter at Swansea Vale, in Wales, and he had taken from the Munitions Department a large acid plant at Avonmouth; he had also, under contract with the British Government, started to build a zinc smelter at the same place. In order to protect these personal ventures, the Burma Corporation's plant in India was scrapped, sacrificing $750,000 above its scrap value. Then Mr. Smith made a deal with the Burma Corporation, of which he was the controlling shareholder, whereby the Corporation bought his Association, taking over his whole interest in that concern and giving him bonds for his holding in the Association, plus a large sum in cash, presumably for his goodwill. In this deal he was joined by Mr. Herbert F. Goedalla, who assisted him in financing the bonds. Whereupon the Stock Exchange took cognizance of the affair and raised an objection, declaring that the interests of the minority stockholders were being sacrificed to those of Messrs. Smith and Goedalla. A committee was appointed to investigate. Mr. Smith was frightened, and cancelled the contract. Then, being unable to save himself financially, he had to turn over the control of his Burma stock to an advisory committee, which now gives orders to the nominal board at Rangoon—a directorate that can do nothing, because its members lack technical knowledge and have no business prestige. On the London committee there is only one person with adequate technical knowledge—Mr. John A. Agnew—for Mr. A. C. Beatty, the other engineer on the committee, takes no interest in the technical phase of the enterprise. Mr. Goedalla bought Mr. Hoover's stock.

Several members of the advisory committee are interested in the Elmore chlorination process and the Chemical & Metallurgical Corporation, by which the Elmore patents have been acquired; therefore the committee made an arrangement for the Burma Corporation, by which it obtains the use of the Elmore process. It was hoped to introduce it in the Burma plant, despite the adverse advice of the manager. Now Mr. Mathewson appears to advise against it, for he says in his report: "Namtu is not the place to experiment with new processes, particularly chemical processes which require skilled European operators." Whether this excellent advice is set aside, we shall see. Meanwhile Mr. Mathewson's services will prove ineffective unless those in control turn over a new leaf and make up their minds to forget the stock market while they apply themselves to the salvage of the Burma enterprise, which is now nearly twenty years old and yet has paid no dividend. It has been the grave of professional reputations because the trail of the stock-jobber has been over it all.

Some Aspects of Mine Labor

Present Shortage of Common Labor—Effects of Restricting Immigration—Newcomer Acquires the Prevalent Attitude Toward Unskilled Work—Competition for Workers—Making Laborers Out of Clerks—Increasing Individual Efficiency—Revision of Ideas Necessary

By Arthur B. Parsons
Assistant Editor

Of the adult males in this country who actually work—this qualification permits the exclusion of politicians, plumbers, lawyers, writers, or any other class, in the reader's discretion—probably 95 per cent are engaged in performing routine tasks. The other 5 per cent do the thinking, the planning, the directing; they tell the routiners what to do and how to do it. If an individual among the 95 per cent is content to stay where he is, he need exercise no initiative; display no resourcefulness; assume no responsibility. He needs only to repeat monotonously a performance that some one else has showed him how to do. Of course many do more because they are striving to get into the 5 per cent group; but that does not alter the essential character of the routine work. The point that I wish to make is that no more imagination or initiative or executive ability is needed to fill satisfactorily the second than the first of the two classes of occupation that I am going to describe. Routine workers may be segregated roughly into two groups, depending upon whether the repetitive performance is primarily with their muscles or with their brains—or rather with a limited number of cells in their brains. The work of the first class can be really understood only by the man who has had an intimate acquaintance with a No. 2 shovel.

". . . *hands out smokes and maybe coupons* . . ."

Definition of "Common" Labor

If you have, for instance, during the course of a month put in thirty eight-hour shifts loading newly blasted ore into a one-ton car in the face of a development drift on the 1,200 level of somebody's mine you know the effort required at the end of the shift to straighten out the fingers that have frozen to fit the shovel handle; and you know the difficulty experienced the next morning, in bending those stiffened fingers to pick up the shovel again. You know how it feels to have the muscles in your arms and legs and back ache at night from the repeated exertion. Perhaps in time you got hardened to it, callouses replaced the blisters on your hands, and the muscles didn't seem to mind; but it was still hard work. The shovel is a sort of symbol of that kind of work we call "common," or unskilled labor. No matter how much machinery may be used, there is always a certain amount of "shovel" work, in mining, in smelting, in railroad building, in the steel industry, in concrete construction of every kind. That is what is meant by "common" labor.

What the Clerk Does

The second class of workers can be grouped under the term "clerks"; they do the routine tasks in retail stores and in offices of a thousand kinds. They worship at the shrine of the White Collar. A clerk in a cigar store hands out smokes (and maybe coupons) and rings up the money; a clerk in a bank counts cash and plays on an adding machine; the clerk in a wholesale house talks into a dictaphone, "Dear Sir—Your order of the 10th instant duly received. . . . Shipment will be made immediately . . . Trusting the goods will reach you promptly and in good order and that we may be favored with future business, Yours truly, etc." And each letter is like all the rest. Clerks do the same thing hour after hour and day after day. Certainly their work demands no more original or constructive thinking, requires little if any more schooling, is no less monotonous, no less "common," if you please, than that of the common laborer. But the clerk's work requires little physical effort, and he can work in an office or a store, instead of in a mill or a shop or a mine, and he can wear a white collar. Whether his standards are right or wrong, he considers himself a few social layers above the man who works not alone with his hands but with his arms and his back and his legs; and unfortunately most of the men who are doing the physical work agree with him. That I believe is one of the fundamental reasons for the labor shortage that is giving such grave concern to industrial employers at the present time. The fact that clerical tasks are "softer," that they do not draw on the vitality to the same extent as do the others, is not to be overlooked; but I venture the opinion that this artificial and imaginary social distinction is far more important than is generally appreciated.

In the lay mind the impression prevails that brains are superfluous in doing common labor and that the useful work accomplished is exactly proportional to the foot-pounds of energy expended. But any mine foreman will tell you that "a little man who can use his head will get more rock into the chute than a man who is twice his size, who exerts himself as hard or harder, but who hasn't any savvy." This is not to say that an intelligent little man can do as much as an equally intelligent big man. Forty years ago hard physical work was performed by almost every one in the ordinary course of events, but the American Citizen of 1923 simply does not want to do common labor, and he will not do it unless he must in order to keep from starving, or unless he sees material profit to himself far in excess of "going" wages as they are today.

The restriction of immigration is an element in the problem that must be considered carefully; although if the reasoning that I shall outline is sound, the beneficial results of a radical change in the policy of the government are greatly overestimated by those who advocate removal of the restrictions.

Statistics show that the ranks of labor, especially since 1900, have been recruited from immigrants from Europe, principally from the Southern countries. The accompanying table shows the number of immigrant arrivals and emigrant departures during the years 1909 to 1921 of sundry peoples and races:

	Arrivals 1909 to 1914	Departures 1909 to 1914	Arrivals 1915 to 1921	Departures 1915 to 1921
Bohemian, Moravian	25,804	3,281	1,606	1,472
Bulgarian, Servian, Montenegrin	57,946	35,387	10,640	30,461
Croatian, Slovenian	127,647	54,463	6,105	9,921
Dalmatian, Bosnian, Herzogovinian	18,545	4,078	794	1,866
Finnish	39,321	11,979	12,282	5,892
Greek	187,271	76,391	74,152	55,259
Italian (North)	135,815	63,883	25,656	26,233
Italian (South)	755,223	345,853	152,680	264,500
Lithuanian	66,705	12,984	2,313	4,129
Magyar	90,071	121,761	5,403	19,130
Mexican	47,096	2,714	77,065	23,859
Polish	381,292	118,580	17,141	47,738
Portuguese	27,303	5,128	31,574	14,174
Roumanian	54,659	14,421	4,369	21,413
Russian	137,916	45,323	13,683	32,214
Ruthenian	92,287	18,213	4,061	1,431
Slovak	87,541	48,514	15,433	21,900
Spanish	34,241	12,305	63,067	25,948
Totals	2,366,683	1,000,258	518,024	607,140

These figures include only males between the ages of sixteen and forty-four years, and for that reason are different from the statistics of total immigration and emigration that are often quoted. Likewise, those peoples are excluded who do not become common laborers when they come to this country. Scandinavians, Germans, French, and British do not emigrate with the intention of polishing the handle of a shovel for a living.

These data were prepared by the vice-president of a large company that owns and operates mines, smelters, and reduction plants of various kinds, to demonstrate in a concrete way the result of the war and the operation of the laws restricting immigration on the supply of common labor in the United States today. The annual average excess of "arrivals" over "departures" of this character during the six-year period from 1909 to 1914 inclusive was 227,738, whereas the average annual excess of departures over arrivals in the seven-year period that followed was 12,761. The official whom I quote estimated that under the 3 per cent immigration law there was a further "net" shortage up to June 30, 1922, of 57,066. If these be added to 1,683,283 ($7 \times 227{,}738 + 12{,}761$) the net shortage becomes 1,740,349. This figure represents the probable additional number of potential common laborers, in excess of the actual, who would have been in this country had not the normal course of events been dislocated by the war and had not the 3 per cent restriction law been passed. This is a larger number of men than the aggregate employed at unskilled manual labor by all the railroads of the country and the entire iron and steel industry when operating normally. Statistics are of course slippery things to handle and they frequently lead to unsound or inaccurate conclusions. However, it is clear that the reduced immigration has been a factor in bringing about the present condition. It does not necessarily follow that the opening of the doors will effect a cure.

The official to whom I have referred has studied the labor problem for years and he declares that the war did much to increase the distaste of young men who were just ready to start earning a living, for common labor. Whereas if they had been left alone many of them might have dropped naturally into the work with which they were familiar, the experience of being taken into the army, where they came into contact with young men from other walks of life, and of seeing more of the world, has altered their outlook on life and has tended to direct their attention to something different. They have felt the seductive lure of the white-collar job.

When we say that there is a "shortage of labor" we mean a shortage of common unskilled labor. And that

". . . a few social layers . . ."

statement should be qualified further by explaining that there is not a numerical shortage of able-bodied men who are physically, even if not temperamentally, fitted to perform all the common labor that is required to promote our essential industries at whatever capacity is necessary. A large proportion of the men who are physically qualified for hard labor are engaged in clerical occupations, and, what is vastly more important, in occupations other than those connected with production. They do the routine work for a class that may be broadly described as distributors.

There are probably between five and ten times as many executives engaged in distribution as are needed; and for every executive there are perhaps a dozen clerks. No blame can be directed toward them individually or collectively; the trouble lies with an economic condition which is generally recognized as being grossly inefficient and wasteful of the time, effort, and energy of human beings. Yet, so long as a man can get for himself more of the material and social advantages of life in any particular occupation, he is not going to take up less desirable work simply because there are more men doing his kind of work than are essential in a broad economic sense.

Excessive Labor Turnover

Another fault with the prevailing organization of industry is evidenced in the fact that more than 1,000,000 wage earners are constantly detached from any payroll. Even when there is no lack of jobs, when employers are crying for workers, there are always from 1,000,000 to 1,500,000 who are for one reason or another shifting around and looking for another job. Human nature is so constituted that this cannot be entirely eliminated, but it would seem that there is room for great improvement when more attention is paid to reducing labor turnover throughout the industries of the country.

The problem that faces the mining company today is to an extent a specific one of getting competent and

experienced underground workers; but behind that is a bigger problem in which they, along with smelting and refining companies, are no less vitally concerned than are the steel and construction industries. If the supply of "common" labor is increased materially there will automatically be an increase in the number of men available for special kinds of hard work like mining. If 10,000 new arrivals from Austria go to work for the U. S. Steel Co., the reservoir of common labor is added to by that much; and indirectly, though no less certainly, the mining companies in Butte, for example, benefit thereby. It is for that reason that the mining and smelting industries are deeply interested in the problem of finding enough workers to fill the ranks of common labor.

Restricted Output of Copper and Steel

We know that copper production is restricted today because of the impossibility of getting men at what the companies call a "reasonable" wage; we know that the Steel Corporation is unable to find men to produce at the desired capacity, at prevailing wages. Expansion of activity in many industries is confidently predicted for 1923, and an acute labor shortage undoubtedly is threatened. The primary need is for the kind of men who will do the shoveling.

The measure for relief that seems most obvious is the repeal of the act restricting immigration. The demand for this repeal is insistent and widespread among industrial executives. They see imperative need for legislation that will permit the entrance of any immigrant, otherwise "qualified," who is physically able to fill the kind of job that is known to be open—which, in plain words, means a job at hard unskilled labor. In explanation of "qualified" I may say that they are emphatic in declaring that the entrant should be of the kind that is assimilable, that he should be free from disease, and be morally and mentally sound. It is contended, correctly no doubt, that the passing of a literacy test neither proves nor disproves mental soundness and is therefore an ineffective and unsound basis for selection.

Immigrants Acquire "Native" Ideas

In short, industry says it wants only men who can be made into good typical Americans within a reasonable period after their arrival in this country. Probably some are insincere when they profess to want good raw or semi-manufactured material for Americans. No doubt some would like to get human machines that would swing on the light end of a shovel indefinitely without acquiring any of the ideas or ideals or aspirations or even the language of the modern American. I am inclined to believe, however, that the foreigner who has a clean and vigorous body is going to have a mind that is at least sufficiently absorbent to gather in a working knowledge of English, with the help of a solicitous Federal Government, and before many years will acquire a desire to do something more "respectable" than a daily stint with his shovel. Especially will this be so with respect to the immigrant who is comparatively young on his arrival. I have known a lot of "bohunk" miners, and it has been my experience that they are prone to gather from their environment the things that their employers would prefer that they did not. They are like the average small boy, in his relations with his playmates and his parents.

The immigrant of the kind classified in the table will not become a scholar in a year or two; he will not become a railroad president, nor a mine superintendent, nor a salaried sales manager; but he will more than likely reach the point, as a result of the "welfare" work and the "Americanization" work and the association with American or Americanized laborers, where he will look upon physical labor just as they do. He will do such work only if he is forced to, in order to earn enough to live. Even if he himself cannot get away from common labor his sons inevitably will grow up, as a consequence of the democratic environment for which the United States stands pre-eminently, with the identical notions and ideas which characterize the sons of native Americans. And one of these ideas is that he is going to be a clerk and not a "common" laborer. It is difficult to see how anything else can be the outcome.

"The only source of able-bodied men . . ."

Open Immigration a Temporary Help

The point I wish to make is this: the widest possible opening of the doors to immigration in itself could at best be but a temporary solution of the labor problem. Even if it were possible (and it is not) for enough Finnish and Greek and Italian and Slovakian and Polish laborers to cross the ocean and enter at Ellis Island, to supply adequately the market for rough labor, let us say during the next five years, where would we be at the end of that time? If the experience of the last ten years is a reasonably accurate guide, the country would simply be depending more than ever on immigration for a fresh supply of foreign laborers to fill the ranks for the sixth year. The only difference would be that many more would be required, for the reason that the excuse-me-from-manual-work population would be immensely increased, partly because of the natural increase from a high birth rate, and partly because of the foreigners that had come in and graduated from the common-labor class. As a temporary emergency measure it may be advisable to throw down the bars now and let in able-bodied men who are at the start anxious to get jobs at common labor; but as a cure for the organic trouble that ails the country it seems to me to be hopelessly ineffective. Even if we momentarily relieve the situation to a small degree by admiting such qualified immigrants as seek admission, the problem will be just as urgent and just as difficult as ever.

Is there an alternative remedy. If so, what is it?

Our industrial growth may be retarded; it probably will be; but it cannot be stopped. When the need becomes sufficiently imperative ways will be found either (1) to induce more men to work, (2) to get more work done by the same number of men, or (3) to accomplish the desired result by a combination of these. Of this anyone but the most gloomy pessimist will feel certain. However, the forecasting in explicit terms of the means by which the end will be reached involves some difficulty. I shall not attempt to do more than enumerate some obvious measures and to suggest a few less obvious tendencies that may possibly play a part in the solution.

Theoretically it ought to be possible simply to go into the labor market, bid for the men and get them. But if a permanent solution is to be effected it is logical to ask whether the required number of men can be spared from other work without crippling industry. The only source of able-bodied men is the group that I have labeled "clerks." Are there tens of thousands of these that could be spared from their present work if they could be induced to make the change? Are there thousands of strong healthy men who could advantageously be displaced by physically deficient men or by young women who are now doing office work of a non-essential character?

The place to look for a surplus of unnecessary workers, as I mentioned before, is among the distributors as distinguished from the producers. Economists agree that the country is burdened with too many middlemen, and with too many retailers; and that this surplus adds unnecessarily to the cost of things to the consumer. Suppose that the clerks employed by 75 per cent of these business houses were released and that the girls and physically unfit men among them took the places of able-bodied clerks in essential business. Thousands of potential "common" laborers would be made available. Would the business of the country suffer if this small army were joined by 75 per cent of the vigorous young men who are getting a mediocre living by peddling stocks and bonds and automobiles and insurance policies and advertising "service"? Many of these young chaps are clerks who have been promoted, and the best of them would make first-class shift bosses and foremen if they had started in as "common" laborers instead of as clerks.

Is anything like this likely to happen? As a consequence of any consciously deliberate action, probably not. But obscure economic and social forces may be at work that are tending to bring about the result that I have attempted to describe.

Socialistic Viewpoint Unsound

To be more practical. If we assume that the earnings of clerks average $6 per day, there ought to be some wage—$8 or $10 or $12—that would induce many of them to quit their jobs and go to work as Knights of the Symbolic Shovel. What is wrong with this theory? Why is this not a reasonable solution? Some one answers "The work isn't worth any such wage." And yet unless one subscribes to the socialistic theory that men are paid solely for their time and that eight hours at one job is worth just as much as eight hours at another, there must be some basis for arriving at an appraisal of the value of a day's work at any particular task as compared with any other. If a task is dangerous, if it subjects the worker to conditions that breed disease, if it wears unduly on his nerves, if it wearies his muscles to an unusual degree, if it compels him to dress in dirty clothes and to wear blisters on his hands —if for any reason it is undesirable, should not the pay be such as to compensate for the bad features? Should not it be such that in the open market for labor it will attract enough men to supply the requirements adequately?

Thirty Dollars per Day!

I have no sympathy for plasterers or other workers who get $20 or $30 a day by virtue of a union that arbitrarily limits its membership and thereby creates an artificial shortage of workmen. Incidentally, why not establish a State Board of Plasterers' Examiners (like the barbers and the doctors) and compel the plasterers' union to admit any man who passed the state examination?

But if an occupation is open to all who are competent and willing; if the operation of the law of supply and demand is not obstructed artificially; why should not the wage be fixed at a figure that in the open market for labor will attract the required number of men?

Employers say, "But high wages will inflate the cost of production and increase the cost of living, and then wages will have to be raised still farther and you are in the clutches of 'vicious cycle.' ". However, only a small proportion of the workers in this country are employed as common laborers. It may be said that if the wages for common labor go up other wages will advance automatically. Yet during the war the white-collar men were far behind the others in the percentage increase of pay. This was a direct consequence of the operation of the law of supply and demand, and the same law may reasonably be expected to compel the increase in the pay of common laborers without a corresponding increase in that of the group that can be classed as clerks. It seems obvious that it is from the ranks of the clerks that the laborers must come; and they will not come unless an adequate difference in the rate of pay induces them.

I am not advocating the payment of higher wages; I am pointing out the fact that that step, disagreeable as it is to employers, is one, though not the only, effective measure for getting needed men. The cost of production may be increased, although it is probable that employers exaggerate the extent of this increase. That, however, is not the question. The question is between two alternatives: (1) limited production, or (2) increased number of workers; and our industrial leaders know better than anybody else that prosperity will depend upon a high rate of production.

High Wages Reduce Efficiency

It is objected that unusually high wages have always resulted in low output per man-shift; that the individual efficiency of the worker decreases as wages rise. This contention is absolutely true. The reason has been that the high wages have always synchronized with shortage of workers in a particular industry; shortage of workers always means that getting a new job is easy; and that, generally speaking, means diminished effort and diminished output on the part of the employee. It is easy to call "the old hole deep enough"

". . . easy to call 'the old hole deep enough' . . ."

when a dozen jobs are to be had for the asking. Suppose, however, that wages for a given kind of work were maintained at a point where the job was particularly attractive and there were many applicants for work? Instead of fixing the wage scale so as to attract *almost* enough men, suppose it were fixed so as to attract just a few *more* than enough. I believe that the individual efficiency would be high. In this opinion, as in others expressed in this article, I am not dogmatic. My conclusions may be wrong. Another objection advanced is that if wages are high common laborers will not work regularly. They can earn enough by working fifteen or twenty days each month to supply the necessaries of life, and they have no desire to accumulate a surplus. There is some truth in this. The negro in the South and the Mexican peon in Arizona are inclined to take the attitude toward life that nothing matters except a full stomach now and a place to go to bed tonight. Tomorrow to them is a long way off. In the mines and smelters of the West, where Sunday is distinguished from other days only by the column it occupies on the calendar, there has always been some habitual "laying-off." A drunken spree on pay days used to be the cause of periodic absence among many workers.

"Tomorrow to them is a long way off."

There seems to be ample evidence, however, to indicate a lessening of these irregularities except among such irresponsibles as Mexicans and negroes. Instead of making men work regularly by paying such low wages that they must be on the job every day or starve, there is a definite tendency to improve industrial conditions so that they want to work regularly. At any rate if our industrial workers are the kind who have no ambition or desire to save money, to educate their children, and to provide for old age, we had better stop letting in the kind of people who have been filling the ranks of labor during the past thirty years. The last generation viewed life differently.

The Dread of High Wages

Most of our industrial leaders are radically opposed on general principles to the mere thought of higher wages. And their attitude is easily understood. To them higher wages simply mean increased cost, and increased cost means decreased sales, or at least decreased profits. Yet Mr. Ford has demonstrated how higher wages can result in decreased cost and increased sales and increased profits.

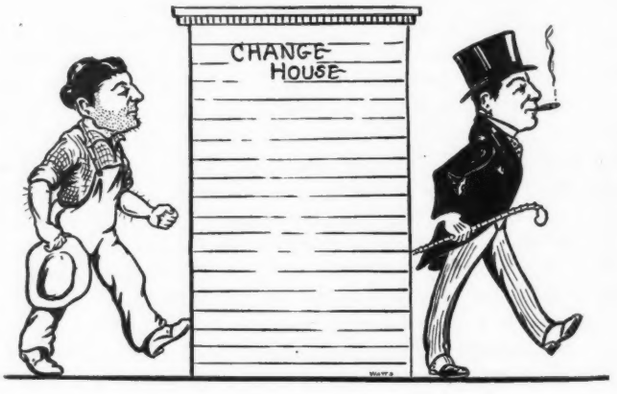
Perhaps the flow of the whole stream of industry in a particular channel makes possible Henry Ford's success in diverting a specific small part of industry; perhaps the whole stream could not be diverted. Nevertheless, administrators may well observe Ford's methods if for no other reason than to overcome their awful dread of high wages of and in themselves. Ford's success is often accounted for by explaining that he gets the cream of industrial labor. Personally, I think that his employees differ from the average only in the mental attitude that they have toward their work. However, suppose that the employer of common labor outbids his competitor, the employer of clerical help, sufficiently to get the cream of the routine workers. Is the comparison a fair one?

There are other things besides high wages that will be influential in inducing men to do hard physical labor. The last fifteen years has seen a remarkable improvement in the conditions that make for simple bodily comfort and welfare of workers.

Consider the change house in the mining industry. At many metal mines today the underground worker can come to his work in a good suit of clothes and, if he pleases, a perfectly good white starched collar. He has a locker for his digging clothes and he has another locker for his street clothes, so that the latter can be kept in good condition. He changes his street clothes from the skin out in a commodious, well-ventilated, well-heated building, where he can take a swim and a shower with both hot and cold water. When he has finished his shift he can walk away from the mine with all the self-respect that comes from having a clean body, well-groomed clothes, and—let us not forget it—a stiff linen collar.

Employees Appreciate Comfort

Twenty years ago the providing of a decent mine change house was seldom considered, or, if it was, the idea was generally discarded as being a foolish extravagance. It would not be appreciated anyway, the management argued. Today there are hundreds of them in the mining industry and thousands in other industries, but I venture to predict that the next five years will see thousands of new and better ones erected and equipped. And they will be appreciated, too. This is merely a concrete example of the measures that will be helpful if the threatened labor shortage is to be avoided or overcome. The start has been made, but much remains to be done.



" . . . walk away from the mine with all the self-respect . . ."

Other measures may be mentioned; for example, making working places as safe and healthful as conditions will permit—and they will generally permit a reasonable degree of each. Likewise, it is of the utmost importance to provide decent places in which to live and in which

to raise a family wherever work of any considerable duration is in progress. As I have said, much has been done in these directions, but there is much room for improvement.

It is objected that such measures will increase the cost of production. Probably they will, but what if they do? We find ourselves at the same old point; the workers must be induced to work, and improving conditions is a cheaper and altogether more desirable way than still further increases in wages.

Use of Machinery Will Help

The main problem may be approached at the same time in another way: increase the output of the individual worker and fewer will be needed. The obvious thing is to develop the use of machinery for performing the arduous tasks. Again, it is true that much has been done, but more remains to be done. The operation in a mine that demands the greatest number of "unskilled" workers is moving ore from the face where it is broken into a car on a haulage level, or into a chute from which it can be drawn readily into such a car. Ten years ago practically all of this ore was shoveled by hand in the good old-fashioned way. During the war the shortage of labor greatly stimulated the development of machines and devices for employing electric or compressed-air power for doing this work. Various types of mechanical shovels were built and steel scrapers of many types were designed to be pulled back and forth by means of wire ropes and small portable air engines. During 1920 and 1921 some companies that had introduced mechanical equipment reverted to hand work, because they found it to be cheaper at the then prevailing wages.

There was no question, however, as to the great economy effected in the number of men required to do a given amount of work. Although it may be cheaper to employ hand shovelers when wages are $4 per day than to use an elaborate and costly machine, it is quite probable that in doing the same work the advantage would lie with the machine when wages were $6 per day.

Moreover, improvements are being made in the mechanical devices which will lessen the cost of maintenance and operation, and great expansion in their use may be anticipated not only for underground work but for similar operations around plants on the surface. It is entirely reasonable to predict rapid strides in the "mechanicalization" of scores of tasks that hitherto have always been performed by hand—by common laborers.

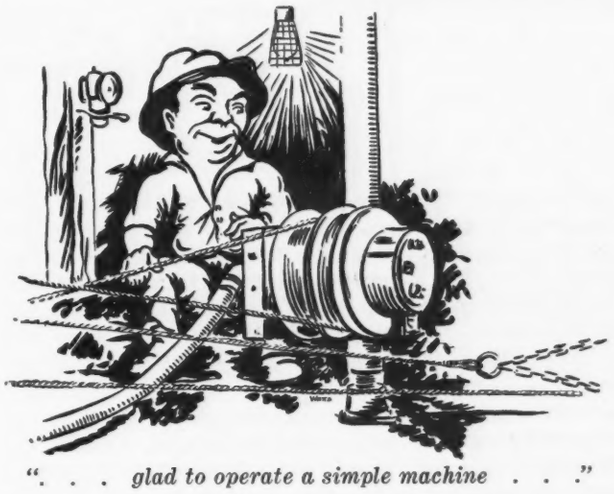
A significant and important point is the psychological effect on the worker. A man who would perform rough hand labor with great reluctance might be glad to operate a simple machine for accomplishing the same purpose.

Contract and Bonus Schemes Increase Individual Efficiency

There is another effective way to increase the average individual output of the worker. That is by the employment of some contract or bonus system of payment instead of a flat wage. This question is a big one; the effectual operation of such a method of payment is a difficult problem, but a few principles are indisputable. In time of industrial inactivity a man may be impelled to do a reasonable day's work by the knowledge that if he fails to do so he may be discharged, and that another job will be difficult to get. If, on the other hand, a shortage of labor exists, these considerations do not influence him and something else must induce him to work. The best inducement is the assurance that his pay check will reflect exactly the skill and diligence with which he applies his effort. Notwithstanding the opposition of labor unions to contract or "piece-work" methods of payment, there is likely to be a wider application of them to common labor. They will increase the output per man, and they will allow the executives who are afraid of the bogey of high wages to pay more without having a high fixed scale staring them in the face. A contract method of payment has a twofold advantage: Not only does it encourage individual efficiency, but it attracts more men and better men to the industry that uses it.

Need of a Psychological Change

Irrespective of what policy is adopted by the government with regard to immigration, whether it decides upon rigid exclusion, liberal admittance or some middle course, it seems to me that there must be a change of attitude on the part of both native and foreign-born workers in the country today, with respect to routine physical as contrasted with routine clerical work. There must be a readjustment in the ranks of routine workers.



". . . glad to operate a simple machine . . ."

Three things seem necessary to get the able-bodied man to do physical work in preference to clerical: He must have the inducement of materially higher pay; he must be provided with a safe and healthful place to work and with an opportunity for a decent, comfortable, self-respecting life when not on the job; and he must undergo a psychological change. These three things are complementary. The greater the progress made in effecting the second and third, the smaller will have to be the inducement of better pay. The most subtle and consequently the most difficult is the third.

The idea that in some way a white-collar job is more dignified, or more respectable or more aristocratic, or is a badge of greater learning, must be overcome. Probably the opportunity that is offered every child for a reasonably thorough schooling will help to obliterate any distinction based on the score of education. Just as necessary is the revision of the ultra modern notion that clerical work confers a degree of social superiority. Most of the men at the top today did their first work in overalls.

Tin Mining in Cornwall in the Year Sixteen Hundred

By J. C. Murray

J. C. Murray

IN THE YEAR of our Lord 1620, there died in Cornwall, Richard Carew, Esquire, a man of light and leading, who left a lasting monument in the form of a book celebrating the natural endowments and charms of his native shire and the vigor and virtues of its people.

Richard Carew was born in the parish of East Antonie in the year 1555. The river Lyner "discharges itself into the Sea above Plymouth." "A little within this Mouth of Lyner," writes Carew, "standeth East Antonie, the poore home of mine Ancestours."

His anonymous biographer tells us that "the Pregnancy of his Parts being much above his Age, he was sent to Oxford in the Year 1566, being then but eleven Years old." After spending three years "in Oxon," and three more in the Middle Temple, Carew was called by his uncle, Sir George Carew, to Dantzig, where Sir George filled the high office of Ambassador to the King of Poland. He followed his uncle to Sweden, returned to England, and traveled in France, "that he might learn the French Tongue, which by reading and talking he overcame in three quarters of a year."

In addition to being a versatile linguist, Carew distinguished himself as an agriculturist. "His Proficiency in natural Philosophy enabled him to improve Agriculture and Husbandry to such a degree, that he was accounted among his Neighbours the greatest Husband, and most excellent Manager of Bees in Cornwall."

His aptitude as an observer and recorder of natural phenomena led him to write a description of Cornwall, which, like many another modest author, "he undertook for his private Satisfaction and Entertainment; but was afterwards prevail'd upon by his Friends to publish it, as we shall see anon."

In the year 1599 (Sir Walter Raleigh being then Lieutenant General of Cornwall) Mr. Carew was one of the Deputy Lieutenants. As Lieutenant General of Cornwall, Sir Walter Raleigh (what "trailing clouds of glory" follow that name!) was also Lord Warden of the Stannaries, having authority over the administration of law and justice and the collection of tithings in the tin-mining districts of Cornwall. As an office-holder under Sir Walter, Carew learned to respect vastly that illustrious adventurer. He also developed a keen interest in the mines and in the miners.

The Book

Carew's "Survey of Cornwall" was first printed and published in the year 1702. This is not the edition, however, that forms the subject of this article. The second edition, published in 1723, and edited by "H—C— Esq." (presumably a later Carew), to which is appended "An Epistle Concerning the Excellencies of the English Tongue," is that which I have before me.

Carew touches on the topography of Cornwall, and then plunges directly into matters pertinent to mining. "The Cornish soyle," says he "for the most part is lifted up into many hils, some great, some little of quantitie . . . and parted insunder by short and narrow vallies . . . In the rest of this earthy description, I will begin with such mynerals as her bowels yeeld forth, and then pass on to those things, of growing and feeling life, which upon her face doe relieve themselves.

Minerals and Metals

"These mynerals," continues Carew, "are not so deepe buried by nature in the entrailes of the Earth, nor so closely couched amongst the Rockes, but that desire of gaine with the instrument of Art can diggee them up: they may be divided into stones and mettals." Touching on quarry stones, he remarks that they are of "sundrie sorts . . . The rough maketh speedier building, the Slate surer. For Windowes, Dornes, and Chimnies, Moore Stone carrieth chiefest reckoning . . . The Sea strond also in many places, affordeth Peeble-stones which serve very handsomely for paving of streetes and Courts." The much-prized blue slate of Cornwall was, even in Carew's time, shipped "beyond the Seas" to Brittany and the Netherlands.

Lime burning was a staple industry. "Copper is found in sundrie places, but with what gaine to the searchers, I have not been curious to enquire, nor they hastie to reveale. For at one Mine (of which I took view) the Owre was shipped to be refined in Wales, either to save cost in the fewell, or to conceale the profit."

Although the existence of silver in Cornwall had been denied by Julius Cæsar, we are informed that this metal has not been withheld by nature. But what nature "proferreth with one hand, shee seemeth to pull backe with the other, whereof some Gentlemen not long stihence made triall to their losse." This is, no doubt, a reference to some contemporary mining misadventure.

Gold is dismissed in a short but noteworthy paragraph: "Tynners doe also find little hoppes of Gold amongst their Owre, which they keepe in quils, and sell to the Goldsmithes, oftentimes with little better gaine than Glaucus exchange." The incident of Glaucus exchanging his golden armor for a suit of iron is told by Homer.

Despite Carew's reputation for veracity, we reserve the right to question his statement that "Dyamonds are in many places found cleaving to those Rockes, out of which the Tynne is digged: they are polished, squared, and pointed by nature: . . . in blacknesse and hardnesse they come behind the right ones." It is not hard to guess that these diamonds were topaz. Mention is made of pearls, agates, and white coral. "But why seeke wee in corners for pettie commodities, when as the onely minerall of Cornish Tynne openeth so large a field to the Countries benefit?"

Carew's panegyric on tin in part reads thus: "In travailing abroad, in tarrying at home, in eating and

drinking; in doing ought of pleasure or necessitie, Tynne, either in his own shape, or transformed into other fashions, is always requisite, always ready for our service: but I shall rather digrace than endeere it by mine over-weeke commendation."

It is then explained, without comment, that the Cornish miners attributed the segregations of tin in Cornwall to the effects of Noah's flood. Corroborative evidence was found in the fact that often they dug up "whole and huge Timber trees . . . Hence it commeth, that albeit the Tynne lay couched at first in certaine strakes amongst the Rockes, like the veines in a mans bodie, yet they have now two kinds of Tynne workes, Stream and Load." The stream, or alluvial deposits, were first worked by the Jews "with Pickaxes of Holme, Boxe, and Harts horne." Proof of this was afforded by "those tooles daily found amongst the rubble of such Workes."

Prospecting and Mining

Prospecting for alluvial tin consisted in trenching until the ground showed a "tempting likelihood." Sometimes in the progress of this work a stream had to be diverted from its course, to the detriment of the fruitful low grounds, which "accuse the Tynners injurie by their succeeding barrenesse."

In prospecting for veins, the "shoad" was traced to its probable source. "There they sincke a Shaft, or pit of five or sixe foote in length, two or three foote in breadth, and seven or eight foote in depth, to prove whether they may so meete with the Load . . . If they misse the Load in one place, they sincke a like Shafte in another beyond that, commonly farther up towards the hill and so a third and fourth, until they light at last upon it. But you may not conceive that everie likelyhood doth ever prove a certaintie." This last note of warning is strengthened by the statement that illusory hope of discovery has been the undoing of many and has made the "adventurers Banckrupt of their hope and purse."

Many stories were current in Carew's time concerning the finding of rich veins through the agency of dreams, but Carew does not ask the reader to give credence to these tales, though he confesses that his own inclination is to believe them.

Prospecting, in a region such as Cornwall, was a relatively unimportant activity. More important were the efforts of those who took over abandoned workings and oftentimes found "good store of Tynne, both in the rubble cast up before, as also in veines which the first workmen followed not." The success of some of these ventures led to high debate as to whether the tin ore grew or not. On this question our author preserves a discreetly open mind, contenting himself with quoting various authorities for and against the theory that ore is self-propagating.

Getting down to matters of practical interest, Carew states that if the "Load wherein the Tynne lieth, carrieth a foote and a halfe in breadth, and be not overbarren, it is accompted a verie rich worke." Commonly, however, the width was not more than one foot, unless several veins formed a junction.

In working old or new deposits, the promoter associated himself with several partners, since the cost was usually more than one man could bear, unless his purse were "lined beyond ordinarie." The hired laborers were paid about eight pence per day, or by the year, when the annual stipend came to four or six pounds, according "as their deserving can drive a bargain." In all cases they had to "find" themselves in board and lodging. Where, I wonder, did the boarding-house keepers' profit come in?

In the larger enterprises an overseer, or mine captain, was appointed. His duties were to appoint each man his task, and to supervise the timbering, pumping, and mining. Carew mentions that the work was so exhausting that in most places shifts of four hours were worked. "The residue of the time" he says, with fine scorn, "they weare out at Coytes, Kayles, or like idle exercises." More than enough holy days were allowed, more indeed than were warranted by "the Church, our lawes, or their owne profit."

The ordinary tools of the miner were the pick-axe, which was about 16 in. long, sharpened at one end and hammer-headed at the other "to drive certain little iron Wedges, wherewith they cleave the Rockes"; and a broad iron shovel, "into which the staffe is slopewise fastened."

The vein was followed "either sidelong or downeright," and always, we are informed, widened with depth. The shafts sometimes reached a depth of 250 or 300 ft. The miners were lowered or hoisted in a "Stirrup, by two men who wind with a rope." Falls of rock seem to have been painfully frequent.

No explosives were used in those days in Cornwall, and sometimes a good workman was hardly able "to hew three foote, in the space of so many weekes." For keeping the mines unwatered there were sundry devices such as "Addits, Pumps, and wheeles driven by a streame, and interchangeably filling and emptying two Buckets." In some places men and horses were kept at work day and night, and in others even these measures were of no avail to stem the incoming water.

An "Addit," or "Audit," is very simply defined as a trench or tunnel, carried through to the mine "somewhat deeper than the water doth lie." Carew digresses at this point to marvel how such great skill as the miners display can be contained in "their (otherwise) thicke clouded braines."

The ore, after being brought to the surface, was first broken with hammers, and then carried either "in Waynes, or on horses backs, to the stamping mill, where three, and in some cases sixe great logges of timber, bound at the ends with iron, and lifted up and downe by a wheele, driven with the water, doe break it smaller. If the stones be over-moyst they are dried by the fire in an iron cradle or grate." Thence the ore passed "to a crazing mil," where it was finely ground between stones. Progressive millmen, however, were dispensing with the "crazing mil" and stamping wet. They thus needed finer grinding only for the "crust of their tayles."

As the pulp left the stamp mill it flowed over successive natural concentrating tables made of green turf. The concentrate was removed from time to time and placed in a wooden dish, "broad, flat, and round, being about two foote over, and having two handles fastened on the sides." In this dish the concentrate was "softly shogged" to and fro until clean of earthy substance. To save labor and do away with the panning, certain innovators hired small boys to "stir it up and downe with their feete." This practice, however, was not looked upon as orthodox by the more conservative element.

The resulting "black Tynne" was divided between the partners after the "Lord of the Tithing" had been assigned his share.

"Then doth each man carrie his portion to the blowing house, where the same is melted with Char-coale fire, blowne by a great pair of Bellowes, moved with a water-wheele, and so cast into peeces of a long and thick squarenesse, from three hundred to foure hundred pound waight, at which time the owners marke is set thereupon."

Having traced the "Tynne" from Noah's flood to the merchantable ingot, Carew now marvels that men should think it worth while to undergo all this travail and peril and expense to win such uncertain reward. "I have already told you," says he, "how great charge the Tynner undergoeth, before he can bring his Owre to this last mill: whereto if you adde his care and cost, in buying the wood for this service, in felling, framing, and piling it to be burned, in fetching the same when it is coaled, through such farre, foule, and cumbersome wayes . . . together with two or three moneths extreame labor, sweltering heate, danger of skalding their bodies . . . and lastly their ugly countenances, tanned with smoake, and besmeared with sweate: all these things (I say) being duely considered, I know not whether you would more marvaile, either whence a sufficient gaine should arise . . . or that any gaine could traine men to undertake such paines and perill. But there let us leave them, since their own will doth bring them thither."

So, also, let us leave them and Mr. Carew along with them, not forgetting to thank the latter for his lively picture of Cornish mining and miners at a time when mining and metallurgy were yet in their infancy.

What a Nuisance Geologists Are!

The following has been guaranteed to us as a true tale:

There was once an opportunity to dig treasure out of the earth and sell it. The property was duly surveyed and bored and it looked good. The man with the option brought it to his rich friend, who is a high and mighty, magnificent and gorgeous financier and a millionaire over and over again. He is a great trader, and his friends feel that to follow him in speculation is almost a royal road to wealth. The option met with his approval, so he organized a little treasure company and let his friends in on the ground floor along with himself. Success was assured with him at the head of it. He is a wonder, as everybody admits. Of course, being rich he is vain, and being vain he will not brook opposition. It is doubtful if anybody has criticized him to his face for twenty-five years. It would be hard to borrow money at any one of a number of banks after such a venture.

Things went well for a time. Treasure was dug out and sold and prospects were bright. Prospects were, of course, what the great president of the concern and the manager, who was the man who had the option, could see. Neither was a geologist, and neither had any interest in all that scientific stuff about "formations" and the like or what happened a hundred million years or so ago. If the stuff is there, buy the land and dig it out. That was the principle.

In time the treasure went off in quality and finally it petered out. The manager hated to give up hope, and finally he saw a light and sought out a geologist who looked over the property. "You're at the very tip of the deposit, according to all evidence," said he. "You've been digging in the wrong direction. Go back instead of forward a few hundred feet and drill. You should find treasure there." So the manager hastened to the president and told him. "Cut it out," commanded the man of might. "I'm through. I've spent too much time on the damned thing already. Close out the business!"

"But this geologist says . . ." began the manager.

"Wha-a-at?" shouted the president. Then in that voice of command that no one dares oppose he repeated, "I told you to close out the whole business." (and to his secretary) "Tell Mr. Bedience that I want to see him at once."

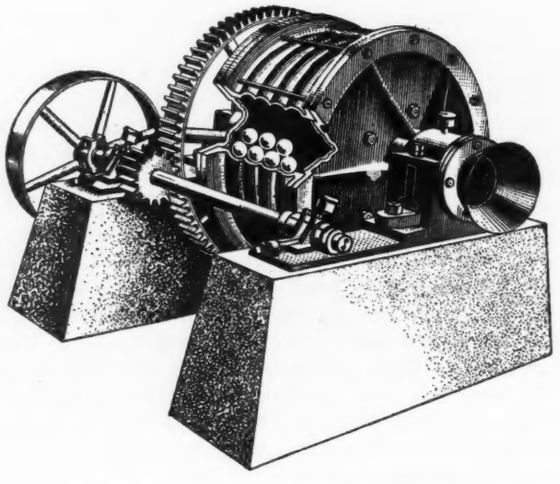
There wasn't anything else to do. The manager got some local capital to buy in the rights, title, privileges, stocks, bonds, and everything else, for a nominal sum. It had always been a small company, a close corporation.

Lately we met a man who is familiar with these regions and asked him if anything had been done with that particular treasure mine. "Anything done?" he asked. "I should say yes! Last year they cleaned up over a million dollars from stuff they got not 500 ft. from the old diggings!"

A Suggested Improvement in Ball-Mill Liners

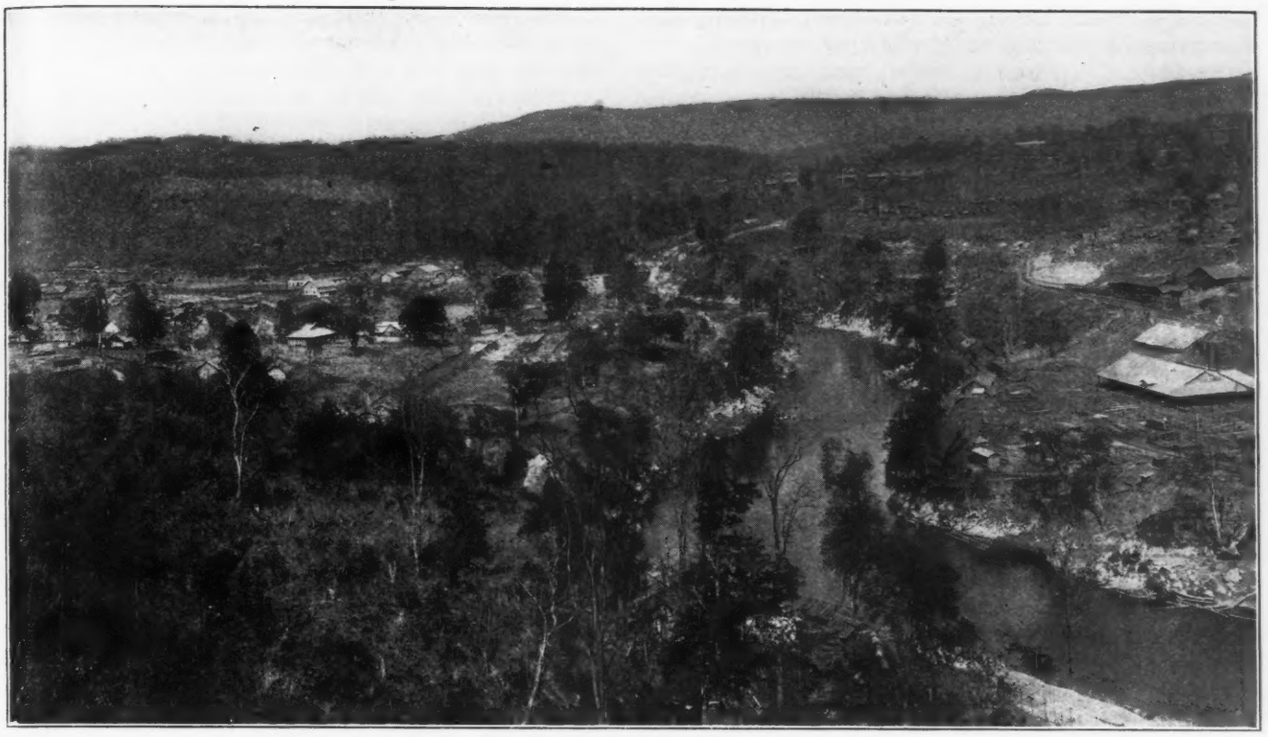
BY E. HEDBURG

The ball mill has been extremely popular owing to its simplicity and large capacity, but it is by no means an economical ore grinder as ordinarily used; it uses up the balls and liners too quickly. The cost per ton milled is higher than it should be; in several instances this cost runs up to 50c. per ton. One cause is that the balls, working against a smooth liner, present at best only a point contact. Rods have been tried out in place of balls, as they present a line contact against the mill liners, but they lack flexibility.



A ball mill with a circular-ribbed liner.

In the illustration is shown a new ball-mill lining, made with grooves for the balls to work in; it gives much greater contact than do flat liners. The mill as here illustrated was first adopted for crushing free-milling gold ores at a prospect, but may be serviceable in large plants as a regrinder, or to take the place of a tube mill. The grooved liners may be made to fit inside any size of ball mill, and will cost no more than any standard mill lining.



General view of Namtu

Smelting Practice at Namtu*

Ancient Metallurgy—Smelting of Slags Accumulated During Previous Operations—Interrelation of Ore-Dressing Procedure and Smelting—Zinc Disposed of by Crowding Into Slag—Conclusion

By R. G. Hall
Late Resident Manager in Burma, Burma Corporation Limited

THE REMAINS of the Chinese smelting and refining furnaces[1] at Bawdwin are of great interest, as they are no doubt similar to those from which were derived modern methods and apparatus. Early workers were interested only in silver; there is no evidence that they produced any considerable quantity of lead, although it is probable that later Burmese operators re-treated some of the old slags and recovered a small amount of lead, probably for ammunition purposes.

The ancient smelting process was designed to extract sufficient lead to carry the silver. For this purpose the Scotch hearth, or the Chinese ancestor of that interesting furnace, was used. The present remains of the Chinese furnaces have no iron work of any kind in or around them. They are simply an excavation in the hillside, semicircular in horizontal section at any point; the radius at the top is two feet and tapers to about nine inches at the sump. The sump is a circular basin, about 9 in. deep. The sump and sides are lined with tamped clay (a low-grade fireclay is found near by). The depth from the top edge of the furnace to the bottom of the sump is between five and six feet. Back of the clay lining are three passages extending from the top edge nearly to the level of the top of the sump. The passages are three inches square in section.

Undoubtedly the procedure was similar to that followed in the Scotch hearth. A mixture of ore and charcoal was placed on the hearth or sump. Air was blown down through the passages in the back of the furnace, and the usual roasting reaction took place, reducing lead and silver.

The litharge from the cupellation was returned to the ore hearth and mixed with the charge. To those familiar with the operation of the ore hearth the desirability for this will be apparent. It increases the amount of lead on the charge and oxidizes the sulphide. The original ore (or concentrate) used could not have contained more than 60 per cent lead. A large amount of zinc makes it difficult to reduce any lead in a 60 per cent charge on the ore hearth. If the proportion of lead is raised by the addition of litharge, even a small amount will have a marked effect on the results. As pointed out, the object was to reduce only sufficient lead to collect the silver. The presence of approximately 1.5 oz. of silver per ton in the slag is proof of efficient silver extraction. The slag in appearance was like the familiar "gray slag" obtained from the Missouri Scotch hearth. It bore evidence of a slightly

*The concluding article of a series of four consecutive articles on the Bawdwin Mines.

[1]Illustrated in article entitled "The Bawdwin Mine, in Burma," by Allan B. Calhoun, June 24, 1922, p. 1089.

greater degree of fusion. It was harder and somewhat less porous, and contained 40 to 45 per cent lead.

Evidence is lacking to show what became of the fume, unless such evidence exists in the large number of graves in the vicinity. The extent of the workings and the length of time that the mine was in operation would account for a good many graves. The smelting was done along the banks of the stream, receding farther from the mine as fuel supplies were used up. The mountain tops on each side are from 2,000 to 4,000 ft. above the valley. The sides were denuded by the gases and at present there is only grass where, no doubt, heavy jungle formerly existed. What percentage of lead was present in the air, in the water, and in the food is an interesting speculation.

Cupellation by the Ancients

Cupellation was carried out in round overfired cupels. The circular sump, in the ground on a hillside, is about 2 ft. in diameter. The sides were built up with clay 6 to 8 in. higher than the front or breast. The grate bars were laid across the sides and, under the level of the grate bars on the back and into the hillside, a short flue was cut. A half-dome-shaped roof was constructed over the grate bars, the crown being about 18 in. above the bars. The fuel was charcoal, and the draft was downward.

Litharge was probably removed by allowing it to freeze on a cold tool or billet of wood. The silver obtained was impure, as the construction and refractories of the furnace did not permit of high temperatures. I found no evidence of further refining in crucibles, but as the Chinese used crucibles in early times, the refining process was completed no doubt when the silver was sent to China.

The discovery by Europeans of the huge slag piles, and the possible profits to be made from the recovery of their metal content, as stated before, led to the first modern operations. A railroad was built from the mine to the nearest point on the Burma railways, and a smelting plant was erected at Mandalay, about 250 miles distant.

Modern Metallurgy Began With Slag Treatment

The slags were derived from ores mined near the surface, that were selected for high lead and low zinc content, and were much less refractory than the slags made in the later European developments. Nevertheless, they presented metallurgical difficulties. The chief problems were commercial. The costs for those earlier operations are not available, but the financial history indicates many difficulties. The recoverable lead content of the slag was from 40 to 45 per cent; silver was not worth recovering. The selling price of the lead was about £13. The gross proceeds from one ton of slag was £5 4s. The transportation cost of the slag to the smelter and the metal to London exceeded £2 per ton of slag, leaving about £3 for gathering, loading, handling, and smelting. The quantity of slags available proved to be about 200,000 tons, although early estimates indicated a much greater amount. The original cost of the equipment, railroad, smelting plant, and other facilities was estimated at £100,000 and exceeded that figure. It soon became apparent that the slag alone would not return the original investment, much less any profit.

The present smelting plant when erected consisted of one 42x100-in. blast furnace and two somewhat larger ones that were moved from Mandalay. A small crushing mill and a few bedding bins constituted the remainder of the plant. A lead refinery of forty to fifty tons' daily capacity was added later. The refinery was designed and built by an experienced metallurgical engineering firm and was the only part of the entire plant designed for economical operation and future growth.

The approaching exhaustion of the slag piles and the opening of valuable smelting ores in the mine made additions to the smelting plant and changes in the metallurgy necessary. A roasting and sintering plant consisting of six Godfrey furnaces (25-ft. hearth) and 18 H. & H. sintering pots was erected. Previous to the autumn of 1918, wood was the only available fuel not only for railway operation but for smelting purposes, the operation of blowers, and mining. A Diesel engine and generator (700 kw. capacity) was, in addition, in use, and coke was used for the blast furnaces.

Smelting operations were changed during the years 1913 to 1918 inclusive to meet the exhaustion of the slags and to smelt the ores from the sulphide orebodies under development. The ores at first extracted were those of highest lead content and were therefore low in zinc. The tonnage necessary to keep the lead-refinery working to capacity was small. The output of refined lead in 1918 was approximately 18,000 tons, or about fifty tons per day, nearly all of which was reduced from sulphide ores.

Interdependence of Mine, Mill, and Smelter

The ore mined during 1918 averaged 42 to 43 per cent lead, and the tonnage smelted by the blast furnaces was, according to the smelter report, 116,000 tons, indicating a lead recovery of about 16 per cent of the weight of the charge. The blast-furnace recovery was poor. The barren fluxes added exceeded the weight of the ore charged. Notwithstanding the dilution, the furnaces gave constant trouble; the campaigns were short, and the quantity of barrings and unfinished products stacked around the plant was most discouraging.

Late in 1918, when I arrived, a beginning had been made toward increasing the zinc tenor of the slag. A survey of conditions at the time was discouraging to a newcomer. The high-grade stopes containing over 40 per cent lead and low zinc were practically exhausted. To maintain a daily output of fifty tons of lead or over, it was necessary to mine stopes averaging 36 to 38 per cent lead and 23 to 24 per cent zinc. Each increase in daily production required the mining of increasing amounts of ore approaching the average of the mine, then 26 per cent lead and 18 per cent zinc. The production of 30,000 tons of refined lead required the mining and smelting of at least 100,000 tons of ore, containing not less than 20,000 tons of zinc.

The slag being formed by the method of dilution contained 14 per cent zinc oxide, 2.5 parts of ferrous oxide to one part of zinc oxide. The iron ore available contained approximately 13 per cent silica and from 62.5 to 64 per cent ferrous oxide. It was evident then that 100,000 tons of ironstone, 50,000 tons of limestone, and 25,000 or more tons of silica would be required. As the only silica available was gossan from the vein matter at Bawdwin, averaging only 65 per cent silica, 40,000 tons would have been necessary. The coke would approximate 36,000 tons.

Excluding for the moment the cost of fluxes and

fuels, under the best conditions prohibitive, transportation would have required an annual railway capacity, for principal products and subsidiary traffic, in excess of 10,000,000 ton-miles. In the best previous year the railway capacity was less than 4,000,000 ton-miles, and as all provision for even maintaining that rate of traffic had been neglected, it was evident that the method of dilution was impossible. Calculation of the lead losses resulting from the huge quantities of slag and the high cost for fluxes and fuels placed this metallurgical method out of the question.

In 1918, the foundations of the concentrating mill were begun. The flow sheet had been planned by careful metallurgists on the basis of the average ore in the mine at that time. The owners of the property had reason to expect that the operation of the mill would solve their difficulties by making clean lead concentrates, nearly clean zinc concentrates, and tailing, small in tonnage but leaving much to be desired.

Most, but not all, of the mill machinery had been ordered. Viewing all the conditions of machinery delivery and transportation, the most sanguine estimates indicated completion of the mill in two years. The crushing department of the mill was operating in November, 1919, and concentration on a limited scale began in June, 1920.

A study of the ore and the flow sheet of the mill indicated that many mill products had been left to be disposed of later by some methods not yet discovered. Undue weight was given in the flow sheet to selective flotation as applied especially to middlings. Further crushing sets free increasing amounts of galena, and it has been estimated (but not proved) that at —200 mesh all the lead and silver minerals would be free from zinc minerals and silica. This might possibly be so, but it would not necessarily prove to be a complete solution of the problem.

Electrolytic Zinc Plant Impracticable

Chemical methods had been proposed for treating middling products, but at that time (1918-19) none of them had reached a commercial scale, and it did not seem to me good policy to delay exploitation of the orebodies pending the development of new processes.

Production of electrolytic zinc had been proposed, and no doubt had much to recommend it. It would simplify the mill flow sheet by giving one concentrate, and would consequently decrease the loss in tailing and eliminate the loss in middlings; it would simplify transportation and marketing. The arguments against an electrolytic zinc plant are as follows: It requires an expensive plant. On the basis of an ultimate mine production of 300,000 tons per annum and 80 per cent recovery of zinc on average ore, 40,000 tons of zinc would be available. This would require additional power of at least 20,000 kw. There is no certain, available water-power for such a plant in the vicinity. Water-powers of such a magnitude exist at a distance within transmission limits, but their development presents difficulties. The ores contain appreciable quantities of copper, nickel, cobalt, arsenic, and antimony that would complicate the operation of a deposition plant. Technical assistance of a high order must be imported. It is doubtful if the returns from such a plant would be sufficiently in excess of those from other available methods to justify the excessive expenditure when amortized over the limited life of a single mine, even one as great as Bawdwin.

A study was made of results obtained in the test mill from the milling of several thousand tons of average-grade ore. The average-grade ore was obtained by mining ores from different stopes. Consideration of the stope maps indicated that a division into two grades of ore could be made—high-grade ore to average 35 per cent lead, and low-grade to average 20 per cent lead. This meant that, if all ores of about 28 per cent lead and over were mined selectively, an average of 33 to 35 per cent lead would result; all other ores combined would average 20 per cent lead; the stopes would, if they could be worked as indicated, yield one ton of the high-grade ore and two tons of the low-grade.

An analysis of the lead concentrating results indicated that a concentrate containing a maximum of 50 per cent lead might be expected (not the 65 per cent concentrate that was based upon the removal of the middlings). It was also shown that the concentrate would contain a minimum of 15 per cent zinc, probably averaging 18 per cent, not over 5 per cent insoluble and 3 per cent iron. The slag finally selected required, for fluxing the zinc as oxide, silica equal to one-third the weight of the zinc oxide and ferrous oxide equal to the weight of the zinc oxide, allowance being made for the silica and iron in the concentrates.

Possible Sources of Silica

The three possible sources of the silica were as follows: (A) the use of mill tailing, containing 4 per cent lead, 10 to 11 per cent zinc, and 50 per cent available silica. (I could not become reconciled to making a separation of this material and again adding it to the concentrates. It just didn't sound right). (B) The gossan from Bawdwin, containing 65 per cent silica, the balance being principally alumina, together with 2 per cent lead. The mining, transportation, and smelting of it would be a dead loss, and would result in a slag high in alumina (it was already high in zinc). It was not an impossible source of silica, but to use it in quantity was not financially or metallurgically inviting. (C) The high-grade mine ore. By using one ton of high-grade direct to each two tons low-grade milled, the milling charge and losses thereon would be avoided. An unfailing source of silica, adjustable to the fluxing demands of the smelting department, would be provided. A metallurgical balance sheet, based on 100 tons of milling-grade ore, was worked out and is given in Table I.

Table I—Balance Sheet for 100 Tons Mill Feed

	Assay				Weight Metal			Per Cent Metal in Product		
Material	Weight, Tons	Silver, Oz.	Lead,%	Zinc,%	Silver	Lead	Zinc	Silver	Lead	Zinc
Mill feed	100	18	20	20	1,800	20	20	100	100	100
Lead concentrates	32	38	50	15	1,200	16	4.8	67	80	24
Zinc concentrates	21	13	10	48	270	2.1	10	15	10	50
Tailings	47	7	4	11	330	1.9	5.2	18	10	26

The balance sheet in Table I was based upon the milling of many thousands of tons in a pilot mill by a careful engineer, and might be presumed to be accurate. As a matter of fact, it proved to be accurate in certain particulars, and not in others. The variations can be ascribed to differences in the ore from different parts of the mine, and to the greater difficulty in the supervision and operation of a 700-ton mill as compared with a fifty-ton pilot mill. Supervision assumes a larger importance in the Burma tropics than it would in more favorable localities, and sufficient allowance is not always made for this variation. Table II, a balance sheet

based on a 20 per cent lead ore, more nearly represents later results.

Table II—A More Recent Balance Sheet Based on 20 Per Cent Lead Ore

Material	Weight, Tons	Assay, Silver, Oz.	Assay, Lead, %	Assay, Zinc, %	Weight Metal, Silver	Weight Metal, Lead	Weight Metal, Zinc	Per Cent Metal in Product, Silver	Per Cent Metal in Product, Lead	Per Cent Metal in Product, Zinc
Mill feed.....	100	18	20	20	1,800	20	20	100	100	100
Lead concentrates	36.5	40	45	20	1,460	16.5	7.3	81	82.5	36.5
Zinc concentrates	10	13	13	46	130	1.3	4.6	8	6.5	23.0
Tailings.....	53.5	4	4	15	210	2.2	8.1	11	11	40.5

The metallurgical tables presented represent results in round figures, and not the exact results in any particular case. Practical operation hitherto has been upon ore slightly above average grade. The recoveries, as expressed in percentage of the metals in the ore, are therefore not exactly comparable with the results in the original test plant. The milling problem is discussed here, due to its important bearing on subsequent operations. Had it been possible to make a commercial recovery of the lead in a high-grade concentrate and to treat the concentrate in the Scotch hearth, procedure would have been simplified and greater profits would have been made.

Balancing of Ores, Fluxes, and Fuel

The problem was one of economics. The metallurgist had shown what products could be made by separation and had shown the zinc limits in the slag. The balancing of the fluxes, fuels, and ores logically followed. Before ore values became so profoundly modified by war conditions it seemed, as stated before, that a certain tonnage of zinc concentrate could be economically produced. The present position of zinc ores and zinc smelting in Europe and Australia make doubtful the value of zinc in a 45 to 46 per cent zinc concentrate at Namtu, Burma, for some time to come.

The smelter requirements, based on the known mill products, mine-run ore, and ironstone are given in Table III.

This represents a general calculation which was based on a slight knowledge of the materials to be smelted. Table IV has been corrected in accordance with the results shown in the mill sheet and on the basis of two tons milled, and the mill products smelted with one ton of high-grade ore.

The slag indicated in Table IV is that actually being formed. The silica and zinc contents are generally somewhat higher, and the lead somewhat lower, than indicated. Ironstone costs delivered about Rs. 18, or $6 per ton. The excess iron is 50 per cent, and the cost is, therefore, 12c. per unit. One ton of 50 per cent iron ore will flux about 0.4 ton of zinc or 0.5 ton of zinc oxide. The cost of coke is high, Rs. 75, or $25 per ton at the smelter. The fluxing problem requires that all possible zinc go into the slag at the smallest cost.

Upper Limit of Zinc in the Slag

Given proper preparation of the charge, low sulphur and a good, coherent sinter, I am not prepared to say what may be the upper limit of the zinc in the slag. Under such conditions 30 per cent zinc oxide is carried with a great deal less furnace trouble than had been formerly experienced with 10 per cent zinc on a silica-iron-lime charge. Granting low sulphur on the charge (consequently no matte), I can see no reason why the slag should not approach one part of zinc oxide to one part of ferrous oxide in composition. The slag (Table IV) is therefore lower in zinc than is necessary. The mill calculation indicates a zinc product that has no present market value, and no prospects of value for some time to come. The results of adding this material to the charge are shown in Table V.

Table V is of interest as it shows at a glance the result of adding the zinc concentrate. Although the slag is dangerously low in silica, as a matter of fact a small amount of mine-run ore and ironstone is sufficient to bring it to a safe composition. The extra twenty tons of exceedingly zinky material could be absorbed for the cost of roasting and smelting. In the past it has been customary to make up an occasional shortage of silica by adding Bawdwin gossan, but this was a temporary measure due to shortage of equipment in crushing, storage, and mining. Obviously, the same results could be obtained more economically by the addition of sulphide ores from the mine rather than by barren flux.

Roasting by Sintering Machines and Pots

The equipment of the plant in the crushing department was extremely poor. The bedding bins were insufficient for a plant of more than 150 tons' daily capacity. As a result, only two days' ore supply was available, and to the difficulties of operating furnaces on a high-zinc charge was added the greater difficulty of not knowing the composition of the charge in advance.

The prime roasting equipment comprised six Godfrey furnaces (25 ft. diameter), and three standard Dwight & Lloyd machines. The Godfreys are fired with oil and have a roasting capacity of 30 to 33 tons of mixture, reducing this to 9 to 10 per cent sulphur, depending on the original sulphur. The fuel consumption is 300 gal. (British Imperial) per day, or approximately 9 to 10 gal. per ton. The results have been moderately satisfactory. The calcines ought to have been lower in sulphur, but accomplishing this greatly diminishes the tonnage handled. Oil costs approximately Rs. 75, or $25 per ton (250 gal.). The fuel cost is from $1 to $1.20 per ton of ore.

The Dwight & Lloyd machines have been used as prime roasters for some time, but until recently the results left much to be desired. The difficulties were many. Absence of a bedding or mixing system prevented any uniformity of charge. Even worse, the sulphur in the prime charge, up to 16 per cent, was much too high. As soon as it was possible to install proper crushing machines, steps were taken to reduce the sulphur by diluting the prime charge with low-sulphur sinter, bringing the sulphur in the charge down to 12 per cent; also to crush properly the intermediate sinter before going to the finishing machines. As a result, the prime and the finishing sinter improved in both quality and quantity to such an extent that it was possible and profitable to shut down the Godfreys and to do all the prime roasting on the Dwight & Lloyd machines. A saving of Rs. 6, or $2 per ton, on approximately 200 tons daily was made, as the daily cost of operating the sintering machines was actually less on the larger than it had been on the smaller tonnage. The fuel used is oil. The consumption on the prime machines is about 1 gal. per ton, the total cost of the operation being Rs. 2, or 65c. per ton.

Finished sinter is produced by both H. & H. pots and sintering machines. There are twenty-three of the former and three of the latter. The costs somewhat favor the sintering machines, owing to the fact that

Table III—Smelter Balance Sheet (*a*)

Material	Weight, Tons	Silver Ounces Per Ton	Silver Ounces	Lead Per Cent	Lead Weight	Silica Per Cent	Silica Weight	Iron Per Cent	Iron Weight	Zinc Per Cent	Zinc Weight	Lime Per Cent	Lime Weight	Sulphur Per Cent	Sulphur Weight
Concentrates	100	40	4,000	45	45	5	5	3	3	18	18	0.5	0.5	19	19
Mine run	100	33	3,300	35	35	15	15	4	4	18	18	1.5	1.5	18	18
Ironstone	60	...	....	....	...	5	3	55	33	....	..	...	...	....	..
To sinter plant	260	28	7,300	30.8	80	9.6	23	15.4	40	13.8	36	1	2	14.2	37
								Ferrous Oxide		Zinc Oxide					
(*a*) From sinter plant	234	31	7,300	34.2	80	10.7	23	21.8	51	19.2	45	1	2	3	7
Limestone	12	...	....	....	...	....	....	....	....	....	..	50	6	....	..
Coke	(25)	...	....	....	...	....	2.5	....	1.5	....	..	...	...	....	..
(Ash 20 per cent)	5	...	....	....	...	....	....	....	....	....	..	...	...	....	..
To blast furnace	271	...	7,300	....	80	....	25.5	....	52.5	....	45	...	8	....	7
Weight of slag produced	154	1.5	231	3	4.7	16.5	....	34.1	....	29.2	...	5.2	...	....	..
Lost in slag															
Per cent of charge	...	...	3.2	....	6	....	....	....	....	....	...	...	...	....	..

(*a*) In this and subsequent calculations no allowance is made for loss of metal in roasting.

Table IV—Corrected Smelter Balance Sheet

Material	Weight, Tons	Silver Assay Ounce Per Ton	Silver Weight	Lead Per Cent	Lead Weight	Silica Per Cent	Silica Weight	Iron Per Cent	Iron Weight	Zinc Per Cent	Zinc Weight	Lime Per Cent	Lime Weight	Sulphur Per Cent	Sulphur Weight
Concentrates	73	40	2,920	45	33	5	3.6	3	2.2	20	14.6	0.5	0.4	19	14
Mine ore	100	33	3,300	35	35	15	15	4	4	18	18	1.6	1.6	18	18
Ironstone	64	....	....	....	....	5	3.2	55	35.2	....	....	....	...	....	..
To roast and sinter plant	237	26.2	....	28.7	....	....	....	....	....	....	32.6	....	...	13.5	..
								Ferrous Oxide		Zinc Oxide					
From sinter plant	203	30.7	6,220	33.5	68	10.7	21.8	26.2	53.2	20.0	40.7	1	2.0	3	6
Limestone	11	....	....	....	....	....	....	....	....	....	....	50	5.5	....	..
Coke	(22)	....	....	....	....	....	....	....	....	....	....	....	...	....	..
(Ash 25 per cent)	5.5	....	....	....	....	....	3.5	....	2.0	....	....	....	...	....	..
To blast furnaces total burden	236	....	....	....	....	....	....	....	....	....	....	....	...	....	..
Slag produced	151	1.5	226	3	4.5	16.8	....	36.5	....	27	....	5	...	....	..
Loss in slag, per cent	...	....	3.6	....	6.6	....	....	....	....	....	....	....	...	....	..

Table V—Smelter Balance Sheet—Zinc Concentrate Included in Calculations

Material	Weight, Tons	Silver Assay Ounce Per Ton	Silver Ounces	Lead Per Cent	Lead Weight	Silica Per Cent	Silica Weight	Iron Per Cent	Iron Weight	Zinc Per Cent	Zinc Weight	Lime Per Cent	Lime Weight	Sulphur Per Cent	Sulphur Weight
Concentrates	73	40	2,920	45	33	5	3.6	3	2.1	20	14.6	0.5	0.4	19	14
Mine ore	100	33	3,300	35	35	15	15	4	4	18	18	1.6	1.6	18	18
Ironstone	64	..	....	..	....	5	3.2	55	35.2	....	....	...	...	..	....
Zinc concentrate	20	13	260	13	2.6	5	1	3	0.6	46	9.2	...	...	28	5.6
To roast and sinter plant	257	..	....	..	....	....	....	....	....	....	....	...	...	..	....
Sinter received	232	..	6,480	..	70.6	....	22.8	....	41.9	....	41.8	...	2	..	7
								Ferrous Oxide		Zinc Oxide					
Limestone	12	..	....	..	....	....	....	....	53.9	....	52.2	...	6	..	....
Coke	27	..	....	..	....	....	....	....	....	....	....	...	...	..	....
Ash (coke)	7	..	....	..	....	....	....	....	....	....	....	...	...	..	....
Slag produced	169	1.5	253	3	5.1	13.5	....	31.9	....	30.9	....	4.7	...	..	....

the pots are dumped and the sinter is broken by hand, but when installation and all costs are included, the difference is slight. No marked difference in the quality or character of the work done is noticeable. In general I prefer the sintering machine for more favored localities, but in Burma there are certain advantages in the use of the simple roasting pots. These advantages are offset to a certain extent, as the work being done in the pot is not so plainly in sight as on the hearth of the sintering machine. The mixture of both sinters seems to have advantages as compared to either one separately.

Much discussion has arisen of late concerning the dilution of the charge for the double roast on sintering machines. Some have claimed great merit from the use of granulated slag, not because it was a diluent and a neutral material, but solely for its wonderful effects as granulated slag. I must confess that, in my limited experience, no magic results have been attained by its use. On the contrary, when used in a fusible charge, it is a great detriment.

The reasons for adding a diluent to the charge are (A) the charge may be too high in sulphur; (B) the charge may be too high in lead or other reducible metal; (C) the charge may be too fine; (D) the chemical composition may require correction. (B) and (D) may be left out of the discussion, as they are not pertinent, and (A) and (C) considered.

Slag was used in blast-furnace charges to keep the charge open. Later, with the advent of the all-sinter charge, the use of returned slag decreased, and finally in many cases even shells were no longer returned. The physical character of the charge was improved, and slag is no longer needed. Simultaneously it was discovered that it never was really needed for any other than its physical action.

The use of granulated slag for the dilution of the sulphur in the charge, and for the correction of the fineness, proved, so far as Burma was concerned, a poor remedy. Dilution was secured, but at the same time a greater fusion took place that resulted in a harder prime sinter, greater difficulty in crushing, and a higher sulphur content in the finished sinter. On the other hand, the use of the finished sinter, crushed to about one-quarter inch but not screened, gave all the advantages of dilution for lowering the sulphur, made the charge more permeable, and, at the same time, added no barren material to the blast-furnace charge. The fineness to which this diluting sinter must be crushed and the quantity to be added must be settled for each case on its merits. Obviously, there are special conditions under which the use of slag may be justified.

In the case of foul slag, the returns may balance the costs, but this is usually doubtful. On the basis of 4c. lead and a blast-furnace cost of $2.40 per ton, three units must be recovered to balance the account, without allowance, however, for refining and transportation.

Blast-Furnace Operations

The finished sinter from the pots and machines is taken to the blast-furnace stock bins in railway cars. Reclaiming is by shoveling into industrial railway cars. The furnace charges are made up in these cars, which are trammed to the furnaces and dumped along each side as required. The method is mechanically and metallurgically bad. Even in a country where labor is cheap, it has not the merit of economical operation to recommend it.

When there is an unduly fine charge, or the sulphur is much above 3 per cent, the furnaces crust up readily and must be frequently barred down. Ordinarily, with a well-prepared charge, one barring per week is all that is required. The actual operation on the tapping floor of the furnace is one requiring skill and experience, as here more than at any other point the results of the preparation of the charge show.

The lime constituent is not added to the sulphide charge, but directly to the blast-furnace charge. This is done because the lime does not greatly improve the quality of the sinter, but tends to make it more fusible and more easily weathered, and it is easier to control the charge when the lime is added directly to the blast furnace. No one constituent of the charge has such mischievous possibilities as lime. With high sulphur, it is the most certain source of trouble. With 10 to 14 per cent lime in the slag, the lead will drop from 2.5 or 3 per cent to less than 2 per cent, and consequently there is great temptation to use it. Unfortunately, the evil effects are cumulative. A slag of the given composition will work through the furnace simply because it is a solvent (under the furnace conditions) for the sulphide compounds of zinc and other metals which form a "mush." The presence of the mush in the slag accounts for the high lead. By the addition of lime, the mush becomes insoluble in, or at least immiscible with, the slag; the lead in the slag decreases, and the beginning of furnace trouble is made. The zinc mush, no longer removed by the slag, accumulates as a crust on top of the crucible until it finally builds up to the tap hole and operations stop. This was conspicuously evident in the experience of an alleged expert sent out by the board from London to show the metallurgist on the ground how furnaces in Burma should be operated. Fourteen per cent lime in the slag resulted in 1.5 per cent lead in the slag. Everything looked as if the "expert" was going to live up to his advance notices. But, alas! This Elysian condition continued only six days. All four furnaces then unanimously refused to yield any more slag from the tap holes, and soon ceased to be furnaces so far as smelting ore was concerned.

The inference would be that the absence of sulphur would make a high lime-zinc slag practicable. I do not know within what limits such a slag could be successfully made, but I understood that such a slag is being successfully produced at present in the smelting of carbonate ores.

Arsenic and nickel form an objectionable speiss, not all of which is soluble in the lead bullion. A mixture of speiss together with zinky mush collects at all times on top of the lead in the crucible, and results in the growth of a crust which requires careful watching. On tapping slag, the furnace must be carefully "rodded," thus keeping open a small space around the tap hole, through which the lead can pass on its way to the lead well siphon. Not infrequently the crust closes over in spite of all precautions, and the furnace front has to be taken out and a hole cut through. The same trouble results when the lead in the crucible is drawn too low, thus giving the mush both time and place to segregate. It is necessary to preserve an adjustment of levels between the lead in the well and the tap hole of the furnace such that small amounts of lead escape into the settler at all times.

Given low sulphur in the charge and proper preparation, the volatilization losses from a high-zinc charge in the blast furnace should not be inordinately high. Burma is not, however, a favored locality so far as labor is concerned; sinter is not always of the highest quality, nor is the greatest care exercised in feeding and tapping the furnaces. Undoubtedly, furnaces can be operated with low losses on this charge, but equipment and labor must be superior to that now available at Namtu.

Losses in sintering are on a different basis. The presence of zinc in excess in the charge of either the pots or sintering machines probably accounts for large losses. It is difficult to say which gives most favorable results, the pots or the Dwight-Lloyd machines. Assays made every day from the finishing sintering machines and from the final pot sinter for six months gave, in the cases of the sintering machines, one unit higher in silver and in lead (indicating 3 per cent less volatilization of these metals), but for some reason the zinc determinations were the reverse and indicated a loss of zinc on the sintering machines 3 per cent greater than on the pots. Most metallurgists know how difficult it is to determine the point of loss and its exact amount in any smelting process involving many separate treatments. Three operations involve both chemical and physical changes as well as change of mass, and two involve change of physical character alone. Periodical samples are at best an approximation, and one can only hope that the errors therein will balance. Weights should be accurate, but moisture samples on intraworks material are not any better than the foreman's guess, and often not as good.

I have not attempted to discuss the constitution of zinc slags, as that is a subject which must be approached with a knowledge of many such slags. A summation of the known facts on this subject would be of value in the discussion of the theory of slag constitution.

Refining Requires Removal of Large Amounts of Dross

The work lead from the blast furnaces is exceptionally impure and requires the removal of large amounts of dross as a preliminary operation. Since 1918 the refinery has been increased from a daily capacity of fifty tons to more than a hundred tons. This was done more by greater efficiency and intensity of operation than by installation of additional equipment. Operation differs in no material details from standard American practice and therefore need not be further described here.

My purpose has been to put on record what has been done in an interesting field in a remote part of the world. A great variety of problems have been pre-

sented to the engineers in charge. The country itself and the remote and almost inaccessible situation of the property have been responsible for the most serious problems. Of the succession of distinguished American engineers whom I had the honor to succeed, each contributed his quota toward the ultimate success of the enterprise. The solution of the problems was complicated by greed, financial trickery, and incompetence, where the various engineers had the right to look for understanding, confidence, and support. Underground and in the plants, order rose out of chaos; output increased and costs diminished, but after the technical problems had been disposed of or minimized, there remained the fundamental difficulties arising from the self-interest of individual owners and the incompetence of officers. However, each engineer, after his short period of responsibility, left for the happier and more pleasant surroundings of home and America with the feeling that he had contributed something toward the solution of one of the most interesting problems of the mining industry.

The nominal board is now composed of employees who are prohibited from acting except under orders from the actual board. The latter is so constituted that positive action of any kind is impossible, or at least improbable. Under these conditions, there is a possibility that the local management will be permitted to operate without interference or overnight changes of policy, and may chiefly concern itself with attaining maximum production, at lowest unit cost, along technical lines already clearly defined.

The property, in my opinion, will hardly justify its huge capitalization, amounting to an issue of 14,000,000 shares of a nominal value of Rs. 10, or nearly $50,000,000, and a debenture debt of £1,000,000. The returns, however, will be liberal on the actual investment in the property, even after making due allowance for mining risk and the unprofitable period.

The orebodies, as now developed, and the metallurgical practice, would justify an output of 50 per cent greater than the greatest output now contemplated. This would bring the earnings of the property to a point commensurate with the nominal capitalization, but would call for an additional investment which the public is in no present mood to supply.

What results the present political conditions in the Indian Empire may have upon the fortunes of the company is difficult to predict. Were the property in India proper, the results would have been already apparent. However, Burma, and the Shan States, especially the latter, are far from the turbulent conditions of India, both geographically and racially. The success of any outbreak in India, or the granting of a greater measure of self-government there, would no doubt be felt in Burma in a more determined demand for participation in government.

Talc in Paint

In recent years talc has been used as a filler in the manufacture of mixed or ready-prepared paints. At first it was used secretively and was regarded as an adulterant; but gradually by actual tests and impartial research it was found that talc had valuable properties that really improved paints used for some purposes. Today paint chemists regard talc as a paint material of great value, and a substantial market is available to producers.

New Zealand's Giant Dredge

New Zealand, as the original home of gold dredging, has long been accustomed to small plants, and considerable controversy has ranged over the comparative merits of the huge installations which have been gradually developed in America compared with the small and more flexible plants to which New Zealand engineers adhere, says the *Queensland Government Mining Journal.* Recently, however, an exceptionally large dredge on the American scale was decided on by the Rimu Gold Dredging Co. This dredge is the most powerful yet put to work in New Zealand, and presents a number of features, both in construction and method of operating, new to dredging there. It cost £100,000.

The pontoon, mainly of Oregon pine, is 115 ft. 6 in. long, 50 ft. wide, and 10 ft. 7¾ in. deep. The working parts are all massive compared with those on previous dredges. By way of illustration, the bucket pins are 6 in., the top tumbler shaft is 21 in., the bottom one 15 in., and the ladder rollers are 16 in. in diameter, and all are of manganese steel. The buckets, seventy-three in number, and delivering at the rate of nineteen per minute, are also wholly of the same material.

The main drive, winch, pumps and stacker are all operated by electric power. To work them simultaneously 535 electrical hp. is required, the figures for the various units being: main drive, 200 hp.; winch, 25 hp.; screen, 50 hp.; stacker, 50 hp.; high-pressure pump, 125 hp.; low-pressure pump, 60 hp.; and nozzle pump, 25 hp. The power is transmitted by the Kanieri Electric, Ltd., to a transformer near the dredge at a pressure of 10,000 volts, and is there stepped down to 2,000 volts.

The most novel features in connection with the dredge are the pivoting of the ladder on the upper tumbler shaft, the dispensation with links between buckets, use of electricity for all power purposes, control of practically all work on board from one central position, stacking by means of belt conveyor, and employment of spuds in place of headlines. The stacker and ladder are each 135 ft. long. The former was designed to dig normally to 43 ft., but can, it is claimed, dig to about 55 ft. if required. The screen is 46 ft. long and 7 ft. internal diameter. The spuds, two in number, are 56 ft. long, and each weighs 18 tons. For saving gold, 6,000 sq.ft. of tables are provided on the dredge. No copper plates nor any description of blanket are used, the gold being caught in shallow riffles in which mercury is placed.

Lantern Slides of World's Deepest Mine Now Available

Lantern slides showing the equipment and operations of the deepest mine in the world, that of the St. John del Rey company, in Minas Geraes, Brazil, can be borrowed from the Department of the Interior, Bureau of Mines, Pittsburgh, Pa., by anyone desiring their temporary use for college and other lectures. Another set shows the method of working at the Ouro Preto mine, in the same state, where the building of dry pack-walls is a special feature. A set of photographs from which the slides were made, and which were brought back from Brazil by Dr. Thomas T. Read, of the Bureau of Mines, who recently visited that country, can be obtained from the Bureau on request. Anyone desiring to obtain duplicate slides can have them made at cost.

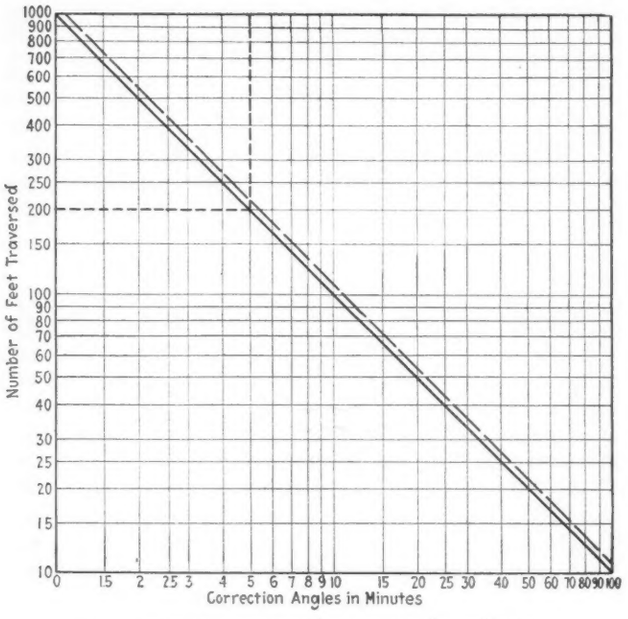
USEFUL OPERATING IDEAS

Correction For Top and Side Telescope

BY JAMES UNDERHILL

To a man constantly using the top or side telescope with a mining transit, the corrections are simple enough, but for one who uses it only at intervals there are usually some difficulties. Part of the difficulty is due to the fact that different makers use different offset distances. If the offset distance is 0.2909 ft. between the main telescope and the auxiliary, the difficulties of calculation are reduced to a minimum.

In calculating the correction angle, the offset distance



Curve giving correction angle in minutes.

or distance between telescopes is divided by the slope distance measured for the top telescope and by the horizontal distance run for the side telescope. If the offset distance is 0.2909 we have:

for 10 ft. $\frac{0.2909}{10} = 0.02909 =$ tan (or sin) 1 deg. 40 min. $=$ 100 min.

for 100 ft. $\frac{0.2909}{100} = 0.002909 =$ tan (or sin) 0 deg. 10 min.

for 1,000 ft. $\frac{0.2909}{1{,}000} = 0.0002909 =$ tan (or sin) 0 deg. 01 min.

This means that 1,000 divided by the distance will always give us the correction angle in minutes. That is, will give it close enough for all practical purposes.

This is a simple ratio and if $y =$ number of feet traversed, $x =$ number of minutes in the correction angle, and we then get $xy = 1{,}000$ or our old friend $xy = \frac{a^2}{2}$, the formula for the equilateral hyperbola referred to its asymptotes. This curve may be graphed with the x axis representing the number of feet traversed, and the points on the y axis will then give the correction angle in minutes.

It is much simpler, however, to use logarithmic cross-section paper. Start the y axis at the lower left-hand corner with 10, place 100 at the halfway point, or 10 on the logarithmic scale, and 1,000 at the 100 point. This gives the number of feet traversed. From the upper left-hand corner to the lower right draw a straight line, as shown. On the x axis the figures represent the correction angle in minutes. Say we have measured 200 ft. horizontally for the side telescope or on the slope for the top. From the 200 mark on the graph we run horizontally until we strike the diagonal line, then we go up on the y axis or vertically until we strike 5 min. on the horizontal scale. The correction angle for 200 ft. is 5 min.

A slide rule which has the B scale inverted may also be used or the ordinary B scale may be turned upside down. Here the inverted scale multiplied by 10 gives the distances and the A direct scale gives the corresponding correction in minutes.

In some handbooks (Hütte and Hudson's Manual for example) there are tables giving $\frac{1{,}000}{n}$, and these may be used to calculate the correction angle, or a table of reciprocals may be used by moving the decimal point.

If the offset distance between telescopes is not 0.2909 ft., graphical methods may yet be used. For example, 0.31 gives 1.1 min. for 1,000 ft., 11 min. for 100 ft., and 106 min. for 10 ft. The constant to be divided by the traversed distance is 1060 +. On logarithmic paper this is represented by a line parallel to our line for 1,000 and a little above.

The slide rule may also be used as before and the distance 106 on B inverted set to 1 on A scale. Opposite ten times the figures on the B inverted read minutes on the A scale.

This extra work could easily be avoided, and it would always be a simple matter to obtain the correction angle, if all instrument makers would use 0.2909 ft. as an offset distance.

Determination of Vanadium in Ores

BY A. H. LOW

In the method here described for determining vanadium in ores the following special solutions are required:

A dilute solution of potassium ferricyanide: about 50 mg. dissolved in 100 cc. of water.

A 20 per cent solution of ferrous sulphate or ferrous ammonium sulphate.

Procedure.—Weigh 0.5 gm. (or 1 gm. if of low grade) of the finely ground ore into an 8-oz. flask. Add 5 gm. of anhydrous sodium sulphate, 5 to 6 c.c. of strong sulphuric acid and about as much hydrofluoric acid as can be held in an ordinary platinum crucible cover (2 c.c.). The hydrofluoric acid is advisable, although not always necessary. Heat over a strong

free flame, with the flask in a holder, nearly to a melt. Allow to cool while distributing the mass around the sides of the flask. This prevents the solidifying cake from cracking the flask and also facilitates subsequent solution. It is best to use a Pyrex flask.

The treatment described will usually effect complete decomposition, but if it fails, try the addition of one-eighth of a 9-cm. filter paper at the outset. The organic matter must, of course, be entirely burned off.

When the flask is sufficiently cool, add 50 c.c. of cold water and 10 c.c. of strong sulphuric acid, and boil to dissolve everything soluble. Now add 5 c.c. of syrupy phosphoric acid and then, from a burette, run potassium permanganate solution into the hot liquid until a decided red color is obtained that persists after boiling again. Use the same permanganate as will be employed in the subsequent titration.

Transfer the hot solution from the flask to a 400-c.c. beaker and dilute to about 200 c.c. with hot water.

Have ready a spot plate and place a drop of the ferricyanide solution in each of the depressions.

Using a small pipette, add the ferrous solution a little at a time to the hot liquid in the beaker, testing after each addition, until a drop of the vanadium solution, taken up on a glass rod and mixed with a ferricyanide drop, produces a blue color.

The ferrous solution first decolorizes the permanganate, then reduces the V_2O_5 to V_2O_4 and, when finally in slight excess, it shows a blue color with the ferricyanide. Try to avoid an unnecessary excess of the ferrous solution. The excess of ferrous salt must now be oxidized to ferric. Run the regular permanganate solution in from the burette until the ferricyanide test fails to develop a blue tinge after standing about half a minute. This should be done as carefully as in a regular titration, as faint tinges of color develop slowly and should be waited for. Toward the last the permanganate should be added a drop at a time.

When the oxidation of the ferrous salt is complete, titrate the still hot liquid with standard potassium permanganate solution until a faint pink color is obtained that after persisting for about a quarter of a minute, perhaps, changes to a faint brown. As a check, the solution may be again heated, the reduction and complementary operations repeated, and titrated once more.

With a permanganate solution containing 1.737 gm. per liter, 1 c.c. = 1 per cent V_2O_5, when 0.5 gm. of ore is taken for the determination. Standardize it against about 0.125 gm. of sodium oxalate (Sorensen's salt). The percentage value of 1 c.c. in sodium oxalate multiplied by 0.7612 will give the percentage value in V, or, multiplied by 1.358, the percentage value in V_2O_5. The permanganate ordinarily used for iron is rather strong for accurate work; its iron value multiplied by 1.63 will give the V_2O_5 value.

The addition of phosphoric acid, as described, materially sharpens the end point of the titration, especially in the presence of uranium.

The above-described modification of a known method gives accurate results. It is a remodification of a description I gave in two recent texts, in which the application of a faulty theory in neutralizing the ferrous iron tended to produce slightly high results.

Burch Ring Grizzly

A new type of revolving grizzly, shown in Fig. 1 and embodying ideas and principles that are novel, has recently been put through a successful trial at the Copper Queen concentrator near Bisbee, Ariz. It is invented by H. Kenyon Burch, the designer of the mill.

Fig. 2 shows the details of construction. Two disks or heads *A* are connected by rods *G* and shaft *E*. The ends of the shaft extend through the heads for support on bearings and to take the driving pulley, as shown. Rings of two diameters are used. Spacers *D* are placed on the rods *G* to hold the smaller rings *C* in position, the inside diameters of which are made to fit the rods closely. The larger-diameter rings *B* are held midway between the smaller-diameter rings by lugs *I*. Thus, undersize that passes between the smaller- and larger-diameter rings at *J* will meet with no resistance in passing out between the same rings at *K*, because the opening at the bottom is greater, due to the larger diameter of ring *B* as compared with ring *C*. Fig. 3 is a side elevation of the grizzly, showing method of feeding and a diagram showing the separation obtained.

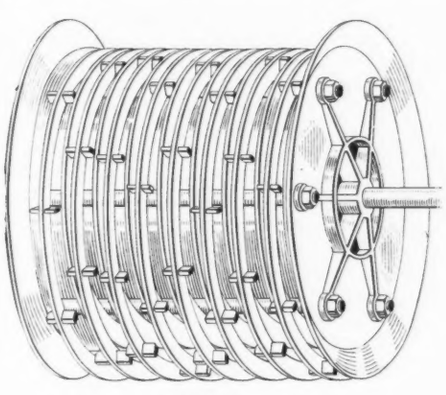


FIG. 1

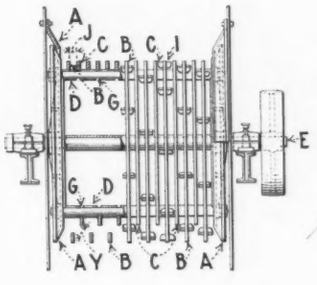


FIG. 2

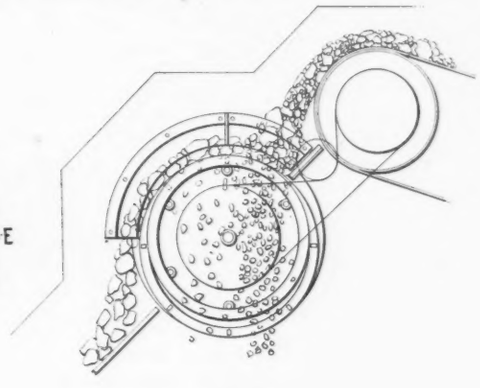


FIG. 3

Fig. 1—Perspective view of Burch ring grizzly. Fig. 2—Details of construction. Fig. 3—Side elevation.

The machine, which is patented, has the merits of ruggedness, simplicity, and low power requirements.

Tags for Plant Machinery

Large plant installations that include a great many small machines that are often shifted from one place to another, such as motors, pumps, drills, and fans, usually necessitate a simple method of keeping record of each unit. This is best done by screwing or riveting a numbered plate or tag of medium-soft non-tarnishing metal on each machine and then compiling a record or directory of all machines.

New Books

Two English Books on Geology

Civil Engineering Geology. By Cyril S. Fox. Crosby, Lockwood & Son, London. Price, 18s. 9d.

The author recalls the fact that a civil engineer, William Smith, was "the father of British geology" as a preliminary to discussing the application of geology to civil engineering. The book is divided into three parts—Water Supply and Irrigation; Field Operation; and Building Materials. Under the first caption are discussed Rivers and Canals, Reservoirs, and Infiltration Channels and Wells; under the second, rather vaguely chosen head of Field Operations, he discusses Retaining Walls, Tunnels and Shafts, Stability of Hillsides, Quarrying and Mining, and Building Sites. Nearly all of the photographs were taken in India; the figures are perhaps somewhat crudely drawn. All in all, the book is a useful attempt to state the considerations which must be paid to geology and civil engineering work; though whether it would be available in its entirety to the engineer who had not a fair special acquaintance with geology, is open to doubt.

The Petrology of the Sedimentary Rocks. By F. H. Hatch and R. H. Rastall. George Allen & Unwin, Ltd., London. Revised edition, 1923. (First edition published in 1913.)

This is an admirable little book, written clearly and with great evident care: and consequently with few noticeable errors, either in statement or in type. It is a book for the student of geology, whether in college or of the class of outside readers who seek to understand the meaning of the rocks. It deals only with the sedimentary rocks. We can recommend it. J. E. SPURR.

Physical Chemistry Up to Date

Within the Atom. By John Mills. D. Van Nostrand Co., New York. Price, $2.

An enchanting and instructive book. By the wizardry that he employs Mr. Mills transports his reader to a new creation —that of the atom—with such dexterity that one feels quite at home and not at all unduly large and awkward. Indeed, one gets to feel on intimate and almost equal terms with an electron, so much so that he scarce can comprehend it when the news is gently broken to him at the end that 10^{-13} cm. represents the order of magnitude of its diameter. The book was written for those who desire to familiarize themselves with the basis of modern physical science, and the author can be said to have succeeded admirably.

Quoting from the preface: "Without mathematical formulation, it deals with modern theories as to matter and energy, emphasizing the granular structure and electrical nature of matter, and the apparently corpuscular character of energy." Those whose knowledge of physics was obtained a decade or more ago may find the book of value in bringing that knowledge up to date. Throughout the exposition of his subject the author has woven a delightful humor which appears at most unexpected places, making the book even more readable than it would be without it. A. H. HUBBELL.

The Mining Manual and Mining Year Book for 1923. By Walter R. Skinner, London. Price, 21s. 6d.

One of the signs of approaching spring every year is the appearance of Mr. Skinner's familiar red-covered book. The present edition is similar to the others and is an authoritative compilation of data concerning the financial organization and operation of the British-controlled mining companies throughout the world, as well as similar information on some of the more important ones under foreign control. There is little technical information except tabular data on mill tonnages and recoveries. The usual table of mining directors and consulting engineers is included.

Metal Statistics, 1923. Published by The American Metal Market, New York City. Price, $1.

This useful little book, containing statistical data on production, prices, and imports and exports of ferrous and nonferrous metals, is now available, with the figures for 1922 and previous years. Buyers of metals and metal products will find it a handy reference book.

Recent Patents

Sampling—No. 1,448,758. March 20, 1923. F. M. Martin, New York City, assignor to American Smelting & Refining Co., New York. A method of sampling ore as it falls in a stream, while loading or unloading cars or bins.

Conveyor for Discharging Bins—No. 1,448,759. March 20, 1923. F. M. Martin, New York City, assignor to American Smelting & Refining Co., New York. An apparatus of the pan or apron conveyor type for breaking up and removing ore from a bin. Patents Nos. 1,448,760 and 1,448,761 cover variations in design.

Ore Concentration — No. 1,448,927. March 20, 1923. Royer Luckenbach, Brooklyn, N. Y., assignor to Luckenbach Processes, Inc., San Francisco. A surface is coated with petroleum grease and liquefied rubber, the mineral in the ore adhering to this compound, whereas the gangue will not. Patent No. 1,448,928 makes use of this idea for concentrating ore, a belt being coated with the mixture, the ore pulp flowed upon it, and the attached mineral being scraped off the belt on its return trip.

Gold Separator—No. 1,448,995. March 20, 1923. John Dee, San Francisco. A gold-separating box, with means for agitating it.

Technical Papers

Talc and Soapstone—"Talc and Soapstone; Their Mining, Milling, Products and Uses," by Raymond B. Ladoo, has recently been published as U. S. Bureau of Mines Bulletin 213, obtainable on request. The bulletin describes briefly the mineralogy, origin, geologic occurrence, and world distribution of talc and soapstone, the latter being of minor importance. The uses of talc and the mining and milling methods and equipment are described in detail. Sixty uses are listed, the chief of which are as paper filler, in pottery, paint, glass, and as an electrical insulating material. An important feature is the emphasis placed on the possibility of greatly extending the field of utilization. Descriptions are given of important talc occurrences and mines in Vermont, New York, Massachusetts, California, North Carolina, at Madoc, Ont., and in British South Africa, together with flow sheets of several of the larger mills. Sixty-five per cent of the world supply is produced in the United States. The publication contains much useful information on a subject greatly neglected in American literature.

Oxygen Breathing Apparatus—"The Value of Oxygen Breathing Apparatus to the Mining Industry" is discussed in U. S. Bureau of Mines *Reports of Investigations*, Serial No. 2,445, pp. 6, obtainable on request to the Bureau at Washington, D. C.

Heap Leaching — A sixteen-page paper entitled "Heap Leaching at Bisbee, Arizona," is available from the A.I.M.E., 29 West 39 St., New York City. It is an account of preliminary test work on heap leaching by the Phelps Dodge Corporation at Bisbee and Tyrone, and of the proposed treatment of low-grade ore removed by stripping operations from Sacramento Hill, Bisbee.

Quarry Accidents—*Technical Paper* 329, issued by the U. S. Bureau of Mines, Washington, D. C., pp. 90, is a tabulation of quarry accidents in the United States during 1921.

Radio Receiver—The U. S. Bureau of Standards has recently issued two circulars, Nos. 120 and 121, describing in simple terms the construction of radio receiving sets using crystal detectors, with a receiving radius up to 75 miles. The price of each circular from the Superintendent of Documents, Washington, D. C., is 5c.

Oil Shales—Bulletin 729 of the U. S. Geological Survey, by Dean E. Winchester, is entitled "Oil Shale of the Rocky Mountain Region." It is based on field work done from 1913 to 1918 inclusive. The physical and chemical character and the distribution of oil shale in the six states covered by the report are discussed at length. Methods and apparatus used in the work are described. A sixty-page bibliography of oil-shale literature is included. Numerous maps accompany the report.

MEN YOU SHOULD KNOW ABOUT

Ira B. Joralemon spent three days in New York last week.

W. H. Blackburn, general manager of the Tonopah Mining Co., has gone to Philadelphia.

W. C. W. Kew, of the U. S. Geological Survey, has gone to California to continue his field work.

A. H. Collbran was in New York last week on his way from London to Denver and San Francisco.

G. C. Klug, Australian manager for Messrs. Bewick, Moering & Co., will leave for London in May.

J. B. Tyrrell, mining engineer, of Toronto, is in charge of operations at the Porcupine Keora mine.

G. R. Mansfield, of the U. S. Geological Survey, will spend a month in Florida examining phosphate lands.

A. P. Garrett, formerly superintendent of the Silver Cup mine, now holds the same position at the Cromwell mine.

E. E. Jones, of the U. S. Geological Survey, left April 20 for six months' field work in Montana, Wyoming, and Colorado.

E. P. Mathewson addressed the senior class of the Michigan College of Mines at Houghton, at the class-day exercises on April 19.

Stewart Campbell, State Mine Inspector of Boise, Idaho, is in the Coeur d'Alene district for several weeks on official business.

E. J. Schrader, mining engineer with headquarters in Reno, has been in San Francisco and other coast points on professional business.

Philip Mond and **D. Owen Evans,** of London, directors of the Mond Nickel Co., made an inspection of the plant at Coniston, Ont., on April 19.

Daniel G. McLachlan, formerly superintendent of the Talache Mines Co., at Talache, Idaho, is now superintendent of the Utica mine, at Kaslo, B. C.

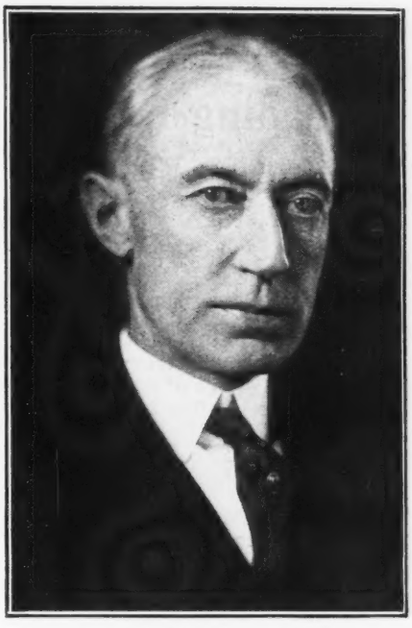
Carl Landsee, of Milwaukee, director of the Hecla Mining Co., visited the mine at Burke, Idaho, following the meeting of stockholders of the company in Spokane on April 10.

J. T. Terry, metallurgical engineer of Salt Lake City, is conducting preferential flotation tests on complex lead-zinc-iron sulphide ore at the Mount Washington Mine, at Wicks, Mont.

Ravenel Macbeth, secretary of the Idaho Mining Association, who was in Washington during the last session of Congress, is now in Wallace, Idaho, where he expects to remain for several weeks.

J. R. Reigart, formerly assistant superintendent with the Cleveland-Cliffs Iron Co., on the Marquette Range, and later with the Comstock Mines Co., at Gold Hill, Nev., has joined the mining department of Henry Ford, at Iron Mountain, Mich.

A new solicitor, in the person of **John H. Edwards,** has been chosen for the Interior Department. As solicitor he will be called on to pass upon many important legal matters having a bearing on the mining industry and on all development taking place on the public lands. Since June 1, 1921, he has been serving the Post Office Department in a similar capacity. It was there that Secretary Work, during his service as



John H. Edwards

Postmaster General, learned of Mr. Edwards' capacity as an attorney. When a vacancy occurred by the resignation of Solicitor Edwin S. Booth, Mr. Edwards was transferred to take that place, at the request of the Secretary. Mr. Edwards was born at Mitchell, Ind., and made that place his home until coming to Washington. He was educated at Indiana University and at Northwestern University Law School. He served three terms as a member of the Indiana Legislature. Practically his entire career has been devoted to the practice of law in his native state.

P. S. Keegel has left Salt Lake City to make examinations of several properties in Arizona for New York interests.

D. F. Haley, of Joplin, Mo., consulting engineer for the American Metals Co., spent several days at Wallace, Idaho, recently. He was formerly consulting engineer for the Callahan Zinc-Lead Co.

Dr. Kenneth C. Heald, of the U. S. Geological Survey, geologist in charge of the Section of Geology of Oil and Gas Fields, is on leave of absence from the Geological Survey, delivering a course of lectures on petroleum geology at the University of Chicago.

C. M. Weld, of Weld & Liddell, consulting engineers, has returned to New York from examination of coal properties in Tennessee. On his way north he stopped at Washington and attended a meeting with government officials of the Manganese Committee, of which he is chairman.

Henry H. Armstead has recently been commissioned colonel in the Engineer Reserve Corps. Since the sale of his interest in the Talache mine, at Talache, Idaho, he has taken options for Armstead Mines, Inc., of which company he is president and manager, on the Utica mine, at Kaslo, B. C., and the Cromwell mine at Ferguson, B. C.

W. E. Simpson, mining engineer of Swastika, Ont., has returned from a visit of several months to London and Glasgow and reports an increasing interest in Canadian mining enterprises. He has arranged to represent the British mining engineering firm of W. Pellew-Harvey & Co. in Canada. Mr. Simpson has gone to the Lake of the Woods district to make an examination of the Mikado mine.

J. F. Callbreath, secretary of the American Mining Congress, will leave about May 1 for a tour of the West. It is probable that Mr. Callbreath will address the National Foreign Trade Council in New Orleans May 2 or 3 on the silver situation, and the inquiry into that subject by a Senate committee. He will speak at the commencement exercises of the Colorado School of Mines on May 18, and will make one or two other addresses before leaving that state; will attend the convention of the Northwestern Mining Association at Spokane, May 22-26, and will attend a meeting of the Board of Governors of the Western Division of the American Mining Congress at San Francisco, June 11-13.

OBITUARY

S. S. Titus, for many years a director of the Callahan Zinc-Lead Co. and its predecessor, the Interstate-Callahan Co., died at his home in Grand Forks, N. D., on April 5. He was a pioneer of North Dakota and founder of the First National Bank, of Grand Forks, and was chairman of the board of directors at the time of his death.

Colonel Joseph Boyle, a Yukon pioneer, died recently in London. He was born in Toronto in 1867 and participated in the Klondyke gold rush in 1898. After undergoing many hardships, he met with some success, and organized the Canadian Klondyke Mining Co., the progress of which was halted by the breaking out of the war. Colonel Boyle was commissioned by the Imperial Government to reorganize the transportation system of Russia, and, after the outbreak of the revolution there, went to Rumania in a military capacity. Following the armistice he was in charge of the relief campaign in that country. During the last year or two Colonel Boyle had been connected with the Royal Dutch and Shell Transport Co., engaged in seeking oil concessions and developing oil wells in Mosul, Caucasia, and elsewhere in the Near East.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

ENGINEERING AND MINING JOURNAL-PRESS has addressed a formal letter to the Secretary of the Treasury urging him to reconsider the decision to revoke the allocations of Pittman Act silver for subsidiary coinage.

Senator Pittman wants conference to consider the position of the "independent" producer of silver, who he thinks is discriminated against.

Reports of important strikes of high-grade ore in the Miami and United Verde Extension mines are not confirmed by officials.

Engineers will investigate alleged platinum discoveries near Spokane, Wash.

Union and operators agree on 50c. wage raise in the Slocan district, B. C.

Oliver W. Krull, mine manager, is reported kidnapped by brigands in Mexico.

Three men are killed working at the bottom of the shaft of a salt mine at Retsof, N. Y.

Tax of $162,000 on sale of Porphyry mine at Miami, Ariz., to the Inspiration company is cancelled by Treasury Department.

Imports of mining and milling machinery into Mexico are growing rapidly.

A new orebody is reported in the Simon Silver-Lead mine, at Mina, Nev.

Revocation of Pittman Act Silver Allocations

"Journal-Press" Urges Reconsideration by the Secretary of the Treasury of Ruling Respecting Subsidiary Coinage Allotments

AFTER taking the precaution of obtaining highly competent legal advice on the interpretation of the Pittman Act and on the opinion of the Comptroller General as to the revocation of the allotments of Pittman Act silver made to the mint for coinage purposes, the *Engineering and Mining Journal-Press* has written, under date of April 24, the following letter to the Secretary of the Treasury. The *Journal-Press* believes and is advised that the statements in this letter are sound from every viewpoint.

"New York,
"April 24, 1923.

"Honorable The Secretary of the Treasury,
"Washington, D. C.
"Dear Sir:

"We beg to refer to your decision to revoke the allocation of ten million silver dollars for subsidiary coinage under the terms of the Pittman Act, and your conclusion that thereby you are relieved of the obligation imposed by such Act to purchase in the United States of the product of its mines the amount of silver equivalent thereto as specified in the Act.

"We have carefully examined the Act and respectfully refer to its title:

" 'An Act to conserve the gold supply of the United States; to permit the settlement in silver of trade balances adverse to the United States; to provide silver for subsidiary coinage and for commercial use; to assist foreign governments at war with the enemies of the United States; and for the above purposes to stabilize the price and encourage the production of silver.'

"The Act permits the Secretary of the Treasury to melt or break up and to sell as bullion standard silver dollars at not less than $1.00 per ounce of silver one thousand fine.

"Section 2 provides that upon every such sale of bullion from time to time the Secretary of the Treasury shall immediately direct the Director of the Mint to purchase in the United States the silver equivalent specified in respect of every standard silver dollar so melted or broken up and sold as bullion.

"Section 3 provides that

" 'The allocation of any silver to the Director of the Mint for subsidiary coinage shall, for the purpose of this Act, be regarded as a sale or resale.'

"The silver producers of the country have interpreted this Act as being mandatory upon the Secretary of the Treasury to direct the Director of the Mint to purchase in the United States the silver equivalent specified of every silver dollar so melted, broken up, sold or allocated and have predicated their operations and made their expenditures upon such a basis.

"This publication endeavors to furnish accurate information to the producers of metal regarding the current price for their product, and to advise them of all conditions that relate especially to the amount used and demand for the same.

"We find nothing in the Act that permits of the revocation of an allocation of silver to subsidiary coinage, but even if such revocation be considered an administration prerogative it manifestly does not permit the Secretary of the Treasury to ignore the mandatory provisions of the Pittman Act to purchase the silver equivalent of silver dollars broken up, melted and sold (or allocated).

"We beg to point out that while it may be to the financial advantage of the Government to revoke the allocation of silver to subsidiary coinage to the extent of ten million dollars so allocated, it cannot be done without ignoring the mandatory character of the Act and the doing of serious injury to the producers of silver who were induced or encouraged by the terms of the Act to push the production of silver.

"We respectfully urge you to reconsider your statement of the amount of silver to be purchased in the United States under the terms of the Pittman Act, and to include thereunder the silver equivalent of the ten million silver dollars so allocated for subsidiary coinage.

"Respectfully submitted,
"J. E. SPURR, Editor.
"Engineering and Mining Journal-Press"

Reported Strikes of High-Grade in U. V. X. and Miami Mines

Arizona Copper Officials Fail to Confirm Stories—Rich Samples Are Shown

Rich strikes of unusual extent were reported to have been made at the mines of the United Verde Extension, at Jerome, and the Miami Copper Co., at Miami, during the last fortnight. Scare headlines were carried by local Arizona newspapers, and a flurry of some consequence developed on the market as a result of the reputed discoveries. The officials of the United Verde Extension have stated that the account of the discovery at their mine is erroneous, and declare that no such ore as has been described has been encountered. The local Arizona officials of the Miami Copper Co. will neither confirm nor deny the report, and no statement is forthcoming from the New York offices. Miners, however, are showing samples of extremely rich ore, very different from the usual "porphyry." The scene of the strike is said to be east of the Miami fault.

Bill Would Create Mine Development Board in Alaska

The creation of a Mining Development Board, with an appropriation of $100,000 for carrying on its work, is provided in H. B. No. 7 now before the Territorial Legislature of Alaska. It is believed to have a good chance to pass. The objects of the measure are to develop the mining industry in the territory by aiding, encouraging, instructing, or advising prospectors and miners; by establishing and maintaining schools or lecture courses in prospecting, mining, mineralogy, geology, and metallurgy; by investigating and reporting on the occurrence of minerals, coals, oil, gas, and other valuable geological products; by examining and reporting on ores, mining prospects, and mines; by providing expert advice to prospectors and miners on the problems of development of mines and the processes of extraction of minerals; by advising with the Road Commission as to the building of trails and roads to prospective mineral areas; by helping to promote the investment of capital in the mining industry in the territory; by investigating and reporting on the proper places for, and types of, smelters, customs mills, and other reduction works, and in determining the ore available for treatment in them.

British America Nickel, Financed, Will Resume

The British America Nickel Co. is to resume operations immediately, the company having been financed to the extent of $1,500,000 in Norway. It is understood that 700 men will be employed at the mines and smelter at Sudbury, and 300 men at the refinery near Ottawa. It is reported that the company has secured long-term contracts with large American steel producers.

Copper Refinery Burns

Damage estimated to be between $500,000 and $1,000,000 was caused by a fire which occurred recently in the refining plant of the Tottenville Copper Co. on Staten Island. The main building, several warehouses and thirty railroad cars were destroyed. The fire was unusually spectacular, due to explosions of acid. The Tottenville company is a subsidiary of the Nassau Smelting & Refining Works, Ltd.

$20,000 Car of Ore From Chief Consolidated Mine, in Utah

The Chief Consolidated mine, at Eureka, Utah, is exceeding its record of production. During March it is stated to have produced about 30 per cent more ore than in any other period of thirty days in its history. During the week ended April 14 this company shipped 88 cars. In addition to ore from the Chief proper, both the Grand Central and the Gemini are making regular shipments. Ore is coming from other parts of the new holdings also. Recently some exceptionally rich ore was taken from the Chief by a lessee, who shipped a car of ore which brought nearly $20,000 net smelter returns.

Union and Operators Agree on 50c. Raise in Slocan District, B. C.

The principal mine operators in the Slocan district, in British Columbia, and the International Union of Mine, Mill, and Smelter Workers have come to an agreement whereby employees of all classes will receive an increase of 50c. per day. By the new scale miners will receive $5, muckers $4.50, metal mechanics, timbermen, jigmen, and teamsters $5.50, and carpenters $6. It is understood that Silversmith Mines, Ltd., whose workmen are affiliated with the One Big Union, has come to a similar wage arrangement with its employees.

Jury Ascribes Death to "Defective Equipment"

"We the coroner's jury sitting at the inquisition of the death of James Keenan, nineteen years old, of Miami, find that said James Keenan did meet his death at 2:05 a.m., on the 14th day of April, 1923, on the 600-ft. level of the Inspiration Consolidated mine while at work on a train, and find his death was caused by defective equipment."

The above verdict was returned by a jury in Miami, Ariz., in which evidence was given by W. A. Slocum, motorman on the train that killed the boy, to the effect that "Some of the ties are so rotten they will crumble when a spike is being driven in them and in many places the tracks are not properly secured." Henry Cassidy, deputy state mine inspector and claim agent for the Inspiration company, testified that he had examined the switch at which the motor that crushed Keenan was derailed "but could see nothing defective."

Oliver Company Will Employ 11,000 Miners on Full Time

Opening of Iron-Mining Season in Minnesota Approaches—Good Demand for Ore Expected

The Oliver Iron Mining Co., a subsidiary of the United States Steel Corporation, and owner and operator of 40 per cent of the iron-ore mines in the Lake Superior district, will open no new mines in 1923, according to an announcement by John E. McLean, general manager. Effort will be centered on developing the previously established properties to meet what is expected to be a good demand for ore. Mr. McLean declares that the company's entire force of approximately 11,000 men would be working full shifts this summer. He thought it probable that 1,000 or more men might be added during the busiest part of the season.

Independent operators in the district report similar activity in advance of the opening of the shipping season next month.

The Mesabi Range, the largest and oldest in the district, is the center of the Oliver company's properties. The company in 1922 moved 15,956,426 tons from its 23 mines, which was 56.08 per cent of the total production for the Mesabi. In 1921 the company moved approximately 70 per cent of the ore shipped from this range.

$50,000,000 Suit Involves Calumet & Arizona Claims

The preliminary hearings of the equity suit against the Calumet & Arizone Mining Co. for $50,000,000 which was brought by the Cunningham heirs is now being conducted before United States Commissioner Edwin J. Jones in Tucson, Ariz. This suit was begun last fall by the heirs of Patrick Cunningham, who, it is claimed, was a partner of Martin Costello and joint owner of certain claims sold by Costello to the defendent company. The guardians of the Cunningham children are attempting to recover from the company, alleging that an equal share of the original purchase price rightfully belonged to Cunningham. This case, which involves some of the most valuable of Calumet & Arizona's holdings, will be tried in the U. S. District Court.

Unusual Terms in Tonopah-King Kirkland Lease

The Tonopah Mining Co., of Nevada, has taken a working option on the King Kirkland Gold Mines on conditions of rather an unusual character. The Tonopah acquires no interest in the mine unless it puts in sight ore to the value of $1,000,000. The option ceases unless work is carried on continuously, and the remuneration to be received by the Tonopah is a 60 per cent interest in the property when the specified amount of ore is proved. The Tonopah also agrees to finance the erection of a mill with a capacity of 100 tons per day, the cost to be met out of profits.

Tax of $162,000 on Sale of Porphyry Mine Is Cancelled

Treasury Department Views Commission on Stock Sale as Part of "Development" Cost

A decision has been rendered by the Treasury Department reversing previous findings in the case of the Porphyry Consolidated Copper Co.'s income and excess profits tax assessed against the company on the sale of its property at Miami, Ariz., to the Inspiration Consolidated Copper Co. in 1921. A tax of $162,000 was originally placed on this sale, the price paid for the property by Inspiration being $1,000,000, but the amount assessed was reduced to $68,000 at the time of the first hearing before the committee on review and appeals. A further appeal of the case has resulted in a total cancellation of the tax, according to the decision just rendered. In deciding this case it was maintained that the commissions paid for the sale of stock were part of the cost of development and were to be added to the cost of the property. The appeal for the company was conducted by Eugene W. Miller, attorney, of Globe, and is probably the largest tax appeal of its kind in Arizona.

Electric Pumps Cut Calumet & Hecla Costs

New Equipment for Tamarack No. 5 Shaft—Electric Hoists Probable

The general adoption of electric pumps in the Calumet & Hecla mines has served to cut pumping costs, and further economies will result from the proposed installation of electric pumps in No. 5 Tamarack shaft to take care of the drainage of the conglomerate shafts. Six pumps will be installed, three at the bottom or 5,000 level and three at the 2,600 level. Each unit's capacity will be 350 gal. per minute and will be operated by a 350-hp. motor. The power line will be extended to the shaft to operate the pumps and a substation will be built. Provision also will be made to supply power for other electric pumps at this branch, including one in No. 4 shaft and two pumps and an electric elevator in No. 1 shaft, Tamarack. The pumps in No. 1 shaft will take care of the surface water, relieving the other pump shafts of a considerable burden.

The pumps and elevator equipment have been delivered, but a year may elapse before the entire project is completed. The shafthouse at Tamarack No. 5 shaft is being dismantled and a new structure will be built. The electric elevator to be installed in No. 1 will be used for the lowering and raising of pumpmen, electricians, and shaft repairmen. Eventually, the Calumet & Hecla properties may be completely electrified, including the installation of electric hoists in shafts and the haulage of rock by electric surface locomotives. This is one of the measures depended upon to reduce to the minimum the cost of producing copper.

Three Killed in Salt Mine

Three employees of the Retsof Mining Co., which is opening salt deposits at Retsof, N. Y., were instantly killed recently when a six-ton casting fell upon them, while they were working at the bottom of a 1,000-ft. shaft.

Mining Machinery Goes Into Mexico Faster Than for Years

It is shown by the custom-house records of the different border ports of entry and deep-water ports that more mining machinery is going into Mexico at this time than for ten years. The machinery is going chiefly to supply mines in the states of Chihuahua, Sinaloa, Sonora, and Durango. Considerable new equipment for ore-reduction mills is also being imported from the United States.

Oliver W. Krull Kidnapped by Bandits in Mexico

Manager of La Cruz Mine in Torreon Held for Ransom

Oliver W. Krull, manager of La Cruz mines, situated in the San Diego district near Velardena, was kidnapped by bandits on April 6 and is being held for ransom. Both the American and English consuls of Torreon are making efforts to learn of his whereabouts and the conditions offered for his surrender. Federal troops are scouring the mountains in the vicinity of Nazas where the outlaws were last seen. Mr. Krull was superintendent of the Mapimi smelter for the Peñoles Mining Co. during the World War. He has been in Mexico for a number of years and held other responsible positions with big mining companies. No report of locating him had been received in Torreon up to April 12.

Spanish Lead Mining More Active

By Cable from Reuters to "Engineering and Mining Journal-Press"

Madrid, April 17.—The recent advance in the price of lead has been followed by a great increase in mining developments in the Carolina basin.

A. S. & R. Has Paid $1,208,000 in Pensions and Insurance

The American Smelting & Refining Co. announces that since the creation of its pension and life-insurance funds, and up to the end of 1922, more than $1,208,000 was paid to employees and their beneficiaries in pensions and life insurance. A fund of $1,000,000 originally set aside for pensions has increased through interest and other accretions and still has to its credit a balance of $1,300,000. A life-insurance fund for salaried employees, originally $500,000, has also increased and now amounts to over $640,000. Pensions have been granted to 521 persons at an average payment of $1,435, and 457 employee beneficiaries have been paid an average of $1,100.

Engineers Investigate Purported Platinum Discoveries in Idaho

Institute and Government Bureaus Are Sampling Deposits and Will Have Dependable Assays Made

Northern Idaho has recently been the scene of many purported platinum strikes in widely separated places. Values in the metal have been reported varying from fractions of an ounce up to many ounces from veins of several mines and prospects. Reported strikes come from the Priest Lake district and the Cynide Gold mines, in Bonner County, and from the Homebuilder and Cariboo mines, in Kootenay County. Spokane assayers and chemists have not been able to verify the reported existence of the metal, and the situation has resulted in a controversy in which it is claimed by the mine owners that the chemists do not use correct methods for the determination of platinum. The assayers assert that they use the standard methods employed by the U. S. Bureau of Mines, the U. S. Mint, and other qualified analysts.

Representatives of the Columbia section of the American Institute of Mining and Metallurgical Engineers, the U. S. Geological Survey, the U. S. Bureau of Mines, and the Idaho State Bureau of Mines are now in the field investigating the properties and collecting samples of the platinum-bearing ore, which will be sent to every government, state, and commercial assayer in the West to determine if platinum exists in the ores. A full report of the results will be made public soon.

Mining Activity in Sinaloa, Mexico, Grows

New Milling and Mining Equipment Is Purchased

In the State of Sinaloa, Mexico, mining development is particularly active. It is reported that the Noche Buena mine, formerly owned by Charles Medbury, has been taken over by the Potrero Mining Co. and a new 25-ton mill is being installed for treating the silver sulphide ores. This property, together with others owned by the Potrero company, is situated in the Mocorito district.

L. Shattuck, of Bisbee, Ariz., is opening up some good copper prospects in the San Lorenzo district of Sinaloa. The main shaft is down to a depth of nearly 200 ft., where the vein has widened to approximately 35 ft., carrying a high percentage of copper. It is expected that machinery will soon be installed on this property for handling the output. Other properties in the San Lorenzo district are being developed by T. J. Wallace. He is sinking a shaft on a strong vein carrying gold and silver. Mr. Wallace will soon install a mill for treating the ores on the ground.

A 60-ton stamp mill and cyanide plant is being installed at the Calera mine, in the Tamazula district, in the State of Durango, near the Sinaloa border. This company is owned and operated by English capital.

News from Washington

By PAUL WOOTON
Special Correspondent

Senator Pittman Speaks for "Independent" Silver Producers

In Letter to Director Scobey He Enumerates Objections to "Future Delivery" Plan—Wants Meeting and Discussion

UNDER date of April 18, Senator Key Pittman addressed a vigorous protest to F. E. Scobey, Director of the Mint, in which he criticised the ruling of the director that he would accept under the Pittman Act from the large smelting companies tenders of silver for future delivery, thereby discriminating, as he believes, against independent producers who might be ready to deliver bullion at the mint. The fact that such producers represent only a small percent of the silver marketed does not alter the justice or injustice of the proposed plan. Senator Pittman urges that a meeting be held, of which all vendors of silver, as shown by the records of the director, are given notice. His letter follows:

"Under date of March 30 you issued a public, written statement or letter announcing the policy of your department relative to future purchases of silver under the Pittman Act. This promulgation, as I understood you to say when I conferred with you upon Friday, the 13th, was the outcome of a conference held upon that day with representatives of the smelter companies who are engaged in smelting ores containing silver.

"I am in receipt of letters and telegrams from a number of producers of American silver protesting bitterly against the proposed plan contained in your letter or proclamation. These letters assert various grounds of objection, embracing such contention as that there is no authority in the Pittman Act to contract for future deliveries of silver; that the method of offer and acceptance is very indefinite, unfair, preferential, and subject to fraud; that it was improper and unfair for the Director of the Mint to formulate a policy after a conference solely with the representatives of the smelters; that there is a conflict of interest between the smelters and the mining and milling companies who are directly producing bullion; that it would be just as fair to permit the miner to tender the estimated value of the silver in the ore broken down in his mine as to permit the smelter companies to tender for future delivery the estimated amount of silver in ores that they had purchased; that the producers of 5 per cent of the silver bullion of the United States are entitled to as much consideration as those who produce 95 per cent of the bullion; that, in fact, the smallest producer of silver bullion in the United States is entitled to as much consideration as all of the other producers put together; that your policy will result in the smelters obtaining a larger proportion of the benefits of the act during the remaining days of its life than will the independent producers.

"I am satisfied that you are not personally familiar with the silver-mining industry and the mining, reduction, refining, and marketing of silver. You, no doubt, relied upon the advice of the representatives of the smelters by reason of the fact that they are the largest marketers of silver bullion, and believing that the representatives of such smelting interests were best informed with regard to the proper policy to pursue. Your lack of knowledge, however, of the facts that I have before referred to caused you to be in a position where you could not anticipate the conflict of interest that I have referred to, the dangers of such a policy, and the injustices and preferences that might arise thereunder.

"The administration of the Pittman Act through your department is of vital importance to a great many producers of silver—in fact, of far more importance than it is to the smelters. Silver is only a byproduct of the smelters; it is the principal product of a number of mines throughout the country. The smelters would continue to operate and prosper on 68c. silver, while a number of our mines would be compelled to close down.

"While I understand and have suggested the reasons that prompted you in acting after a conference with the smelter representatives, I am forced to suggest that it was a regrettable occurrence. In all friendship, I earnestly urge you to immediately call a meeting of all of those of whom you have a record who are interested in the administration of the Pittman Act; that said meeting be held at the earliest possible date, and that due notice be given by wire of such meeting to all of those interested as shown by the records of your office.

"Whether you see fit to modify your policy and the proposed program or not, you would at least have the advantage of free discussion of the subject in your own office rather than through the press and at public meetings."

Bolivian Tin Mining Prospers

The mining industry in Bolivia is becoming more prosperous every day, says D. C. McDonough, U. S. Consul at La Paz. Exports of tin concentrates amounted to 53,237 metric tons in 1922, the largest quantity ever exported in any one year.

An American company is planning to put in a mill with a capacity for treating 200 tons of ore daily, which will make it the second largest tin mine in Bolivia. Chilean capitalists hold options on several mining properties in Bolivia, which they may exercise and start several new mines. The rumor persists that a Bolivian capitalist who controls the largest tin mines in the country has sold them to American interests.

Too Much Advertising in Interior Department's "Movies"

The use of industrial motion pictures has reached a point where the Secretary of the Interior believes a more uniform policy should be adopted in the preparation of such films. The various bureaus of the department heretofore have proceeded separately without regard to a common policy.

There has been some criticism of government films on the ground that they give undue advertising to certain companies. A thorough investigation of the whole subject is being made, with the purpose of establishing a policy and expanding materially the production of this type of motion picture.

Eight War Minerals Awards—Commission Resigns

An award of $3,252.66 to the Kromite Mining Co., of Payette, Idaho, has been recommended by the War Minerals Relief Commissioner. This claim was rejected by the former commission because of lack of request or demand. Under the amended act, however, the company was able to establish stimulation from the published appeal of President Wilson. The commissioner finds that allowable losses subsequent to April 21, 1917, aggregated $3,252.63.

In another recommendation, the commissioner recommends an award of $1,975.90 for Walter S. Watson, of Wichita Falls, Tex. The property, however, is situated near Batesville, Ark. In the opinion of the commissioner, stimulation was had prior to the beginning of operations in August, 1918. He also is convinced of the commercial importance of the property. Other recommendations made during the week ended April 21 follow: Arentz and Perkins, Alhambra, Calif., $1,299.39; William Snowden, Bellevue, Idaho, $3,769.37; Burton, Glenn and Evinger, Fresno, Calif., $898.84; Barnes and Barnes, Watts Valley, Calif., $1,012.25; Sims and Allen, Birmingham, Ala., $574.45; O. R. Mascall, Doyville, Ore., $397.72.

Ira E. Robinson, the War Minerals Relief Commissioner, has resigned. His resignation is to become effective May 1. The volume of work on war minerals claims has now been reduced to the point where it is probable that no successor will be named. For the present at least the activities of the staff engaged in passing upon the remaining claims will be under the immediate direction of the solicitor of the Interior Department. The offices of the commission are being moved from the second to the fifth floor of the Interior Building so that they will be contiguous to the offices of the solicitor's department.

Navy Department Will Sell Much Metal

The Navy Department has called for bids for the purchase of large quantities of brass, copper, zinc, cable, chain, and steel. Bids are to be opened at the New York Navy Yard on May 1.

Gold-Silver Commission Summons Treasury Officials

Director of Mint Answers Queries—His Report for 1920 Gives Repurchases as "About 208,000,000 Oz. Fine"

THE Under Secretary of the Treasury and the Director of the Mint have been summoned to appear on Thursday, April 26, before the Senate Commission of Gold and Silver Inquiry. They will be asked to explain various phases of the handling of purchases of silver under the Pittman Act and will be asked if there is any reason why the Comptroller General should not be requested to review his decision in the light of facts that may not have come to his attention at the time his opinion was handed down.

Senator Oddie, of Nevada, on motion of Senator Pittman, of the same state, was elected chairman of the Commission of Gold and Silver Inquiry, at its initial meeting. Senator Sterling, of South Dakota, was elected secretary of the commission. Prior to the meeting, Senator Walsh, of Montana, had authorized Senator Pittman to act for him until he could join the commission, while Senator Gooding, of Idaho, designated Senator Oddie to represent him. In this way, it is believed that more decisive action can be taken.

Due to the urgency of reaching a settlement in the controversy over the amount of silver still to be purchased at $1 an ounce, it was determined to concentrate attention on that question for the present.

In reply to a questionnaire submitted by the American Gold and Silver Institute, at the instance of the commission, the Director of the Mint has submitted the following:

"The silver which entered into the subsidiary coinage in 1918 to 1921 was obtained from various sources. Bullion pertaining to any particular account or source is not kept physically separate from other bullion. The allocations revoked in conformity with the Comptroller's decision of Nov. 29, 1922, represent approximately the quantities used from the sources named, viz: 1,658,246 oz. of silver bullion purchased under the Pittman Act, and approximately 8,589,730.13 oz. obtained from melted silver dollars ($11,111,168); other silver used was that purchased in the usual course of business—fine silver bought in the open market and silver contained in deposits of gold.

"The legal authority under which the Director of the Mint purchased silver bullion since April 23, 1918, other than that purchased under the Pittman Act, will be found in Sections 3520 and 3526 of the Revised Statutes.

"The reason the allocation of 6,000,000 fine ounces of silver to the subsidiary coinage account was not absorbed was that the demand for subsidiary coin ceased and the bullion was not needed for the manufacture of such coins."

In this connection, the American Gold and Silver Institute has submitted the following observations:

"On page 8 of the Report of the Director of the Mint for 1920, under the title 'Silver Operations Under Pittman Act,' the following statement is made:

"'Subsidiary silver coin demands necessitated melting, under the terms of the Pittman Act of April 23, 1918, an additional 10,000,000 silver dollars at the Philadelphia Mint, which operation was begun Dec. 5, 1919, and completed March 22, 1920. These dollars were allocated or sold to the Director of the Mint at face value; their manufacture into subsidiary silver coin will produce a profit of $692,068.43. This operation gives a total of 270,121,554 dollars melted under this act. . . .

"'The act provides for the repurchase of the same quantity as contained in the dollars melted, about 208,000,000 ounces fine.'

"1. If a profit of $692,068.43 was made by the manufacture of silver dollars allocated into subsidiary silver coin, it is evident that a still larger profit was made through the conversion of all of the silver dollar allocations made. It would appear that this profit is destroyed if the said allocations are revoked. If this is so, the profit earned by virtue of this conversion of silver dollars into subsidiary coin offsets the profits of the Treasury which the Comptroller General cites in his decision.

"2. The above quotation from the Director of the Mint's Report also serves as official notification to the silver producers that 270,121,554 silver dollars have been melted under the Pittman Act and that the act provides for the repurchase of the same quantity as contained in the dollars melted—namely, about 208,000,000 oz. fine. The decision of the Comptroller General to revoke these allocations substantially reduces this amount 10,248,000 oz., and it is difficult to understand how the allocation of silver dollars which resulted in the actual minting of subsidiary silver can be revoked."

Iron Ore Rates for Three Ranges Reduced by I.C.C.

Rates on iron ore from the Minnesota ranges at Mesabi, Vermilion, and Cuyuna to Lake Superior ports are reasonable, the Interstate Commerce Commission holds, but present railroad charges on iron from mines in Michigan and Wisconsin to lake ports are too high, and reductions are ordered.

From the Gogebic Range in Michigan to Ashland, and from Menominee, Mich., to Escanaba rates hereafter are to be 72c. a ton, the commission decided, the present maximum being 90c. From the Marquette Range to Marquette reductions of 5c. a ton were ordered, making the future maximum from mines at Ishpeming and Negaunee 54c. a ton and 63c. a ton on shipments from mines elsewhere in the range. Dock charges in connection with the railroad rates were held to be reasonable at present levels over all of the lake ports.

Complaints which resulted in the reductions were brought by eighty-seven independent mining companies.

Phosphate Deposits Will Be Examined

Geological Survey to Investigate Fields in Florida—Work in Idaho Completed

Examination of the phosphate deposits of Florida on public lands withdrawn from entry by the Secretary of the Interior in 1910-13 has been undertaken by the Geological Survey. Simultaneously an investigation of patents which are in dispute will be conducted.

More than 100,000 acres of land in northern and middle Florida are believed to contain phosphate rock which have been withdrawn from entry by the Interior Department. Individuals assert patent rights to some of this property, and a number of discrepencies in records have developed. Much of the land, however, never has been claimed for patent by private individuals.

The geological work will be conducted by G. R. Mansfield and G. W. Holland, of the Geological Survey. The latter already is in Gainesville comparing records, and he will be joined by Mr. Mansfield before the end of the month.

Mr. Mansfield is completing a report on the phosphate deposits of Idaho, which will be submitted to Philip S. Smith, acting director of the Survey, before he goes to Florida. The Idaho deposits are extensive and of good grade. The greatest development in that state is that of the Anaconda Copper Mining Co., which has built a seven-mile railroad to its prosphate mine and has established a plant to produce superphosphates, using acids from its smelting plants in Montana.

War Minerals Decision Involving Purchase Price To Be Appealed

The Secretary of the Interior has announced his intention to appeal from the decision of Justice Hitz, of the Supreme Court of the District of Columbia, in which it was held that the purchase price of mining property is a proper item to consider in adjusting war minerals losses. The appeal is to the District Court of Appeals and cannot be heard until next October. It is the contention of the Interior Department that the law does not intend that claimants are to be reimbursed for their expenditures in mining properties.

Whether or not the decision is sustained, attorneys for the Interior Department point out, claimants will have little chance of securing such reimbursement, as it is apparent from the debate on the war minerals relief bill and its amendments that Congress was not inclined to make repayment for real-estate purchases. For that reason it is believed that Congress would not make the appropriation necessary to the payment of the purchase-price items.

Pittman Act Silver

Purchases of silver by the Bureau of the Mint during the week ended April 21 amounted to 2,022,516 oz. This brings the total purchases (including tenders for future delivery) under the Pittman Act to 182,785,584 fine ounces.

News by Mining Districts

By Special Correspondents in the Field

Johannesburg Letter

Dust Sampling Important Work on Rand—Decreased Gold Yield

BY JOHN WATSON

Johannesburg, March 20—The annual meeting of the Transvaal Chamber of Mines will be held on March 26. The reports of the various committees show that the chamber's activities have been in behalf of employees as well as owners. During the year, 22,172 samples of mine air were dealt with by the chamber's dust-sampling department. Four dust-sampling surveys of the mines were made during the year, the average dust content per cubic meter of air being 1.6 mg. A total of 14,711 samples taken by the Konimeter method of dust sampling were counted, the average for stopes being 130 particles and for development ends 270 particles. In addition, 352 water and 218 air samples were analyzed.

The following table shows the comparison between the Transvaal gold output for the years 1921 and 1922:

Witwatersrand

	1921	1922	Decrease
Yield, fine ounces	7,924,534	6,813,172	1,111,362
Estimated value	£42,330,246	£31,437,134	£10,893,112

Outside Districts

Yield, fine ounces	190,052	206,938	(a) 16,886
Estimated value	£1,015,195	£954,847	£60,348

Transvaal

Yield, fine ounces	8,114,586	7,020,110	1,094,476
Estimated value	£43,345,441	£32,391,981	£10,953,460

(a) Increase.

The output of diamonds for 1922 in the Transvaal Province was 415,707 carats, valued at £1,192,637, compared with 424,487 carats, valued at £1,254,-151, for 1921.

The values of the copper and tin outputs have been:

	1921	1922
Copper ore	£1,420	nil
Tin ore	£138,670	£59,393

The board of directors of the Brakpan Mines recommend an increase of capital by the issue of 170,000 new shares, which will be offered to shareholders at 30s. per share. The proceeds of this issue are to furnish funds to complete the development program and also to complete the purchase of the Schapenrust claims, which are being acquired on terms favorable to the Brakpan company. A circular to shareholders dealing with these matters is now in course of preparation.

At the Messina Copper Mine, during February, 9,000 tons of ore was hauled and concentrated. Two furnaces are now in operation, and about six truckloads of blister copper (99 per cent) are now ready for railing and shipment to the United Kingdom.

A third refining furnace will be brought into operation, first for producing more blister; and later it will be used for the production of refined ingots (99.5 per cent) for local use.

The Crown Mines, Ltd., has acquired, from the government, undermining rights of an area equal to about 494 mining claims on portions of the farms Mooifontein, 14 and Vierfontein, 15.

London Letter

Globe and Phoenix Declines to Die—Cordoba Hopes to Develop Copper Mines

BY W. A. DOMAN

London, April 12—The Globe and Phoenix Mine (Rhodesia) seems both to confound its critics and to surprise its shareholders and directors. For two years or so, it has been thought that twelve months would see its exhaustion, but it goes merrily on. At Dec. 31 last, ore reserves showed a slight increase over those at the end of 1921. Some years ago, a special development reserve fund of £100,000 was set aside; of this, £10,000 has been appropriated. With the balance, apparently a vigorous development program is to be undertaken. For what was supposed to be a dying mine, the immediate prospect now seems to be cheerful. Hopes have been raised by the discovery of the oreshoot in the footwall leader at the 19th and 20th levels. There is a large area in this leader between the 15th and 19th levels only partly explored, and it is now thought to be improbable that this ground can be barren in view of the good results obtained at the 13th and 14th levels, and again at the 19th and 20th. The consulting engineer states that at the 26th or deepest level the geological conditions are favorable, though the reef at present is unpayable. The company earned a profit last year of £139,756; in 1921 the profit was £182,144. The tonnage milled was 75,397, and mine development redemption charged was 9s. per ton, the total expenses per ton, apart from taxation and depreciation, being 57s. 6d. Ore reserves are estimated as:

	Tons	Ounces	Value
Available	69,400	70,000	£294,000
Ore in pillars	44,300	75,900	318,780
Total Dec. 31, 1922	113,700	145,900	612,780
Total Dec. 31, 1921	110,000	140,100	588,420

Two interim dividends of 1s. and a final of 1s. 6d. per share, have been declared.

A good deal of discussion has taken place on the annual report of the East Rand Proprietary Mines, in which it is stated, as regards development, that the outlook is very grave. As a result of the white workers' strike in the early part of 1922, production and profits were seriously affected. Members of the Stock Exchange express themselves pretty freely, and in their opinion the position is made to look worse than it really is. They suggest that the debentures are to be redeemed as early and at as low a rate as possible, after which the way will be clear to amalgamate the ground with the Cinderella Consolidated. It is a pity something cannot be done for the latter, but at present there is the difficulty of finding new capital.

The Cordoba Copper Co. (India) is issuing 2,200,000 new shares of 2s. each for the purpose of developing copper mines "of excellent potential value" at Mosaboni, Dhobani, Surda, Lankesra, and Badhia. An expedition under E. R. Woakes is at the properties, and is most favorably impressed with the prospects. At Mosaboni, the ore reserves within the next two years should be at least 300,000 tons of about 3½ per cent. Handling 100,000 tons per annum and with an extraction of 75 per cent, best copper can be produced for £75 per ton, taking 3 per cent ore and £15 per ton for development.

Underwriting of a new issue of shares in the Tolgus Mine (Cornwall) is in progress. The company was originally formed in 1919 by East Pool and Agar, and it is believed that the rich lodes in the latter extend into the former, and that although the Tolgus is flooded, it can be unwatered and the tin formation which has taken the place of the old copper-bearing formation can be successfully attacked.

San Francisco Letter

Conference at Sacramento—North Star Gold Cost 86½c. per Dollar

Special San Francisco Correspondence

San Francisco, April 20—Mining men are feeling the expanding influence of a forward spring and are evidencing it in getting together. Under the auspices of the Sacramento Chamber of Commerce, they attended a meeting in Sacramento on April 20, 1923. Mother Lode operators, engineers, and mining men generally were present. Subjects of special interest were discussed. These were the world's need of gold, maintaining the dollar price of silver, the revival of the copper industry, development of industrial materials of California, the future of the State Mining Bureau, new mining legislation, power and its relation to mining, the work of the U. S. Geological Survey, and the opening of the Mother Lode. Such meetings are stimulating and awaken interest and merit the support of mining men, provided they are not held at too frequent intervals.

An official report in the form of a sworn statement is being required from mining companies whose stocks are listed on this exchange by the San Francisco Stock Exchange. The statement includes both financial and operating data. The practice of a stock exchange maintaining an adequate record of the companies whose stocks are bought and sold is not new and is

essential in maintaining control over operations in worthless stocks.

The Shasta copper belt has only one large mine in operation, the Hornet mine of the Mountain Copper Co. This mine is producing pyrite for the chemical industries of the bay region. The Mammoth, Shasta Zinc & Copper Co., and the Afterthought are closed, although there is a nucleus of a working crew at both the Mammoth and the plant of the Shasta Zinc & Copper Co. The Afterthought is in the hands of its creditors and does not hold out much hope of early resumption. It is rumored that both the Mammoth and Shasta Zinc & Copper Co. will resume operations in the near future, but preliminary arrangements are still in the making. In the meantime, minor operations in Shasta, Siskiyou, and Trinity counties are more active than usual. There is potential mining ground in northern California, and such operations as are at present going on might easily result in the discovery of important properties.

The annual report of the North Star Mines Co. contains the news that the visible ore resources of the mine are being rapidly exhausted and that an aggressive development campaign has been initiated which might entail during 1923 a partial or complete cessation of milling operations. During 1922, the company delivered to its sorting plant 154,569 tons, of which 38,696 tons was discarded as waste and 115,600 tons was milled, averaging $9.41 per ton. Average cost of operation was $6.99 and development $1.14, leaving an operating profit of $1.27 per ton crushed. The cost of producing $1 worth of gold in 1922 was 86½c., compared to 54c. in 1912. The operations of this well-known mine are indicative of the difficulties of the gold producer and show that he deserves greater co-operation on the part of communities that prosper by reason of his efforts.

BURMA

Good Results at Namtu

The Burma Mines, Ltd., from its mines at Bawdwin produced during March, 23,201 tons of ore. At Namtu, 24,000 tons of ore was milled in the treatment plant, producing 11,663 tons of lead concentrate. A total of 9,491 tons of lead-bearing material was smelted in the blast furnaces, producing 3,538 tons of hard lead for treatment in the refinery. Refinery products were 3,612 tons of refined lead and 366,312 oz. of refined silver. Tonnage milled includes the re-treatment of 2,027 tons of tailing.

Tasmanian Tin Mine to Reopen

By Cable from Reuters to "Engineering and Mining Journal-Press"

Melbourne, April 12—After being closed down for a year, the Mount Bischoff company's tin mine, at Waratah, Tasmania, will resume activity at the end of April. It is said that 880 men will be employed.

PERU

Cerro de Pasco Running New Smelter

The new Cerro de Pasco smelter, in Peru, is now getting most of the current output of the mines, although the old plant is still in operation. The smelter cost about $10,000,000 and is modern in every respect. Reduced operating costs are expected as a result of starting the new plant. The site is at a much lower elevation than that of the old plant, which was 14,000 ft. above sea level.

BRITISH COLUMBIA

Trail Ore Shipments

The ore receipts at the Trail smelter for the first three months of the year totaled 115,113 tons, of which the Consolidated company's Sullivan mine contributed 100,825 tons, the Republic and Northport mines, in the State of Washington, 8,327 tons, the Slocan and Ainsworth districts, 4,280 tons, and the East Kootenay district 1,024 tons, the remainder coming from scattered districts.

Consolidated Opens Old Sport Mine

The Consolidated Mining & Smelting Co. is reopening the Old Sport mine, at Quatsino Sound, Vancouver Island, which has been closed since the fall of 1920. Twenty-five men have been put on development work and more will be added a little later. It is rumored that the company will erect a concentrating plant on the property during the fall, and it will reopen the Sunloch, in which it has a controlling interest. This mine was closed in the fall of 1920.

Premier Dividends Total $3,650,000

The Premier Gold Mining Co. disbursed a dividend of $500,000 on April 4, covering the previous three months' operations. This brings the total disbursement to date to $3,650,000, but the annual report, covering last year's operations, seems to indicate that the present dividend rate cannot be maintained much longer unless other bonanza discoveries are made on the property. The present ore reserve averages about $35 per ton, and the ore in the bottom level runs between $9 and $10 per ton.

Stockholders Ratify Florence Sale

The sale of the Florence mine to a Duluth syndicate was ratified by the stockholders at a meeting held in Ainsworth recently, nearly 1,000,000 shares of stock of the Florence company being represented at the meeting. The city of Nelson has made an offer to supply all electric power needed by the mine for contemplated increased operations.

Silver Crown Finances Mill Construction

The Silver Crown Mining Co. near Trout Lake, B. C., will erect a mill on its property the coming season. The property has been undergoing development for several years, and has now reached a stage where it is claimed ore reserves warrant the erection of a 75-ton mill. The development work has exposed ore on the 400 level, which was developed at 300, 200, and 100 ft. and varies from 3½ to 5½ ft. in width. A smelter test indicates gross values of $100 per ton. Seymour Birch, of Spokane, Wash., is president. Arrangement has been made with eastern interests to finance the proposed work.

New Oreshoot at Cork Province

What is reported to be a new orebody has been discovered in the Cork Province mine, at Zwicky, B. C. The new strike was made on the hanging-wall side of the vein in the 100 ft. winze level. The ore is of the usual tenor of the Cork Province mine, but dimensions of the shoot have not at this time been ascertained. Plans call for starting the mill the latter part of April.

ONTARIO

Hollinger Gets Power Grant

An official announcement has at last been made that the Ontario Government has granted the Hollinger Gold Mining Co. a power site at the Long Sault rapids, with permission to develop 25,000 hp. The province retains rights on the surplus power which the Hollinger company develops. The case of the Northern Canada Power Co. vs. Hollinger is being continued. This action will determine if the Hollinger agreed to sign contracts for all its power requirements. The Hollinger evidence has only been partly presented, and the Power company's evidence has not yet been submitted.

MEXICO

E. P. Palmer Locates Claims

Edward P. Palmer has recently located four new groups of mines near the city of Zacatecas. They are recorded as El Tigre, situated in the Cuate Mountains; the General Obregon, comprising eight contiguous claims in the Perla Mountains; the Aquilon, of six claims, and the 16 de Septiembre, in the Alto range of mountains. The principal metals in all of these properties are silver and lead. Development work is already begun on some of the principal veins, and shafts are being sunk.

Naica Property, in Litigation, Will Be Sold

The holdings of the Naica Mining Co. are to be sold to satisfy a large indebtedness to the Peñoles Mining Co. The property consists of the narrow-gage railroad leading from the Naica mines to the Conchos station on the main line of the National Railways of Mexico, together with locomotives, cars, and general equipment; also the round-house and machine shops. The following mines, with the installed machinery and surface buildings, are also to be sold: The Xochitl, El Triunfo, La Descubridora, Las Reinas, and the Ampliacion. Prior to the revolution this company was one of the largest shippers in the State of Chihuahua. Its bankruptcy was caused by the mines becoming involved in litigation.

ARIZONA

C. & A. Plans Purchase of New Claims

A meeting of the Leadville Mining Co.'s stockholders has been called for April 24 for the purpose of considering the sale of a part of the company's property to the Calumet & Arizona Mining Co. An offer of $75,000 has been made for three patented claims and one unpatented claim, located near Courtland, Ariz. The Leadville company owns a number of claims in the Courtland district which have been worked intermittently for the last few years.

Conclusion of Pittman Silver Purchases Will Shut Down Tombstone Mines

Silver producers of Arizona are working night and day, putting forth their utmost efforts, to get all possible metal to the market before the expiration of the $1 per ounce guarantee. In many instances three shifts have been put to work and all available miners and equipment are being used. At Tombstone, where many small leases are being worked, every effort is being made to have all ore in sight cleaned out as soon as possible. Production from that district during the first two weeks of April will nearly equal that of the entire month of March, and it is expected that the total output for the month will reach as high as seventy-six cars.

There are a few producers at Tombstone that should be able to continue production after the expiration of the Pittman price for the metal, but the majority are planning to suspend operations. Shipments from Pearce have been greatly increased during the last two weeks, several cars a day being shipped to the Douglas smelter. A reduction in the price of silver will also mean a great loss to the copper producers of the state, especially the smaller operators, whose ores are of high silver content.

Kay Copper Will Develop

The Kay Copper Co., whose mine is situated at Cannon, about 50 miles north of Phoenix, is organizing a crew of workmen preparatory to resuming development work. Arthur Jenks is manager, and Jack Flynn, formerly of Miami Copper Co., and recently with El Oro, is to be the new superintendent. Extensive development is to be carried out.

Officials Visit Verde Central

The directors of the Calumet & Arizona and New Cornelia companies have been in Bisbee district to attend the annual meeting of stockholders of the two companies. After an inspection of the holdings and the completion of the meetings, during which all of the officers were re-elected, the directors of the Calumet & Arizona left for Jerome to visit the Verde Central mine. Calumet & Arizona became interested in the Verde Central property and is backing an extensive plan of development which is now under way.

Crown King Development Is Financed

D. M. Lacey has succeeded in securing money to proceed with the development of the property of the Crown King Mines Co. near Flagstaff. The holdings include the Tiger, Wildflower, Arizona Yucca, and Crown King properties. Frank M. Murphy, of Prescott, a former owner of the property, built a railroad to the mines in 1913. In 1915 David Gimmell and associates took an option to work the old tailing dump of the Crown King and with oil flotation recovered about $160,000. These men formed a new company in 1917 known as the Bradshaw Reduction Co. This company recovered from the tailing of the Tiger mine $57,850. The company also sunk the Wildflower mine shaft from 200 ft. to 700 ft.; and in developing and stoping extracted $104,072. That was in the days of 30c. copper. In 1919 copper was at 12c., so the Tiger and Wildflower mines were abandoned.

After the death of Frank Murphy, the three mines, Tiger, Wildflower, and Crown King, were sold to Mr. Lacey, in February, 1920. In December, 1921, Lacey incorporated a company to be known as the Crown King Mines Co., and took over the Arizona Yucca property. The mines have available a good water supply, and electric power. The company owns $200,000 in equipment on the Crown King ground. The ores contain gold, silver, zinc, and copper, and samples as high as $60 have been reported.

Arizona Binghamton Resumes

The Arizona Binghamton copper mine, at Stoddard, near Mayer, is to resume production about April 15, after a shutdown of more than two years. The workings have been kept unwatered and all equipment has been kept in excellent condition during the time of suspension. A new three-compartment shaft was completed just before the shutdown. A small force will be employed at the start, but will be increased later. Concentrates will be shipped to the smelter of the Southwest Metals Co., at Humboldt.

MONTANA

Silver Dyke Mill Handles 400 Tons Per Day

Capacity at the new mill of the Silver Dyke Mining Co. at Neihart has been increased to 400 tons a day, within 100 tons of the maximum tonnage expected to be handled when the plant is at full capacity. Concentrates shipped from the mill aggregate approximately one car a day, and 100 men are employed.

The mill was started early in February and is demonstrating a greater efficiency than had been anticipated by the owners. It was at first estimated that the mill would save 87 or 88 per cent of the ore, but it has been demonstrated that a much better recovery can be made. The ratio of concentration is 14 to 1. An economical caving system of mining is said to be working satisfactorily.

IDAHO

New Mill for Hecla—Star Crosscut Should Be Finished in October

James F. McCarthy, at a recent meeting of stockholders of the Hecla Mining Co. at Burke, Idaho, announced that if the development of the Wide West vein, in which a strike of importance was recently made, meets expectations, a new mill will be constructed for the treatment of the ore, as increasing the capacity of the present Hecla mill is impracticable on account of water shortage. Mr. McCarthy also stated that preparations are being made to sink 400 ft. from the 2,000 level of the Hecla mine, and if the showing at that depth is satisfactory another 400 ft. would be sunk, following which the main shaft would be extended to the new level. The shaft that is now to be sunk will be alongside the big oreshoot and about 2,000 ft. from the main shaft. Another interesting announcement was that the Star crosscut, which is being driven by the Hecla and Bunker Hill & Sullivan companies from the 2,000 level of Hecla, should reach the Star vein within 2 300 ft., and at the present rate this distance should be accomplished sometime in October. The successful carrying out of this great enterprise recalls the sensational litigation in which the late E. R. Day, a Hecla stockholder and manager of the Hercules mine, and Mrs. Sarah E. Smith, the largest individual stockholder of Hecla and at the time a director of the company, endeavored permanently to enjoin the Hecla directors from joining the Bunker Hill & Sullivan in the purchase and operation of the Star mine. The outcome of the trial was a complete victory and vindication of the Hecla officers and directors and the management of the Bunker Hill Company.

Ajax Development Progresses

The Ajax Mining Co., control of which is owned by Massachusetts stockholders, is carrying out an important development enterprise near Burke. This is a crosscut tunnel which will be a little more than a mile long and which will cut the Ajax vein at great depth. Considerable ore has been developed in the upper workings, which justifies the expectation of finding a large orebody at the increased depth. A statement just issued by A. C. Bixby, manager of the Ajax, says that on April 1 the crosscut had been advanced 3,563 ft., leaving 1,900 ft. to go. The crosscut passes through the ground of the Moonlight Mining Co., in which there is also a possibility of ore discovery.

Large Payroll in Coeur d'Alene

A conservative estimate places the number of men employed by the mines of the Coeur d'Alene district, Idaho, at 4,000. Taking $5 per day as the average wage—and it is probably more than that—the combined payrolls amount to $600,000 per month. From present indications these figures will be materially increased through expansion of present operations and new development work this summer.

OREGON

Copper Trust Prepares to Ship—Other Homestead Properties Produce

A new strike in the Copper Trust Syndicate mine, near Homestead, is attracting attention in that district. A body of ore has been struck on the 300 level, in which the top, bottom, and sides of the drift have been in ore for 20 ft., which will run 5 to 6 per cent copper, and carries gold and silver. The width of the body has not been determined by crosscutting. Plans contemplate shipping in the next sixty days, and ore bins will be erected on the railroad at once. The adjoining Iron Dyke mine is shipping copper ore to the smelters daily and has been credited with a gross output of $4,000,000 to date. This company, which recently resumed operations, has added large ore reserves by diamond drilling during the period of shutdown.

The Bay Horse mine, in this district, is shipping steadily a good grade of silver ore, and the Red Ledge properties of the district are going forward with a two-year program to develop a large low-grade copper deposit.

Gem Mine Plans Cyanide Plant

The Gem mine, in the Susanville district, has developed 18,000 tons of ore averaging $18.25 per ton, and a cyanide plant of 60-ton daily capacity is now under construction. Extraction of 92 per cent is claimed, at a cost of $6 per ton.

Sumpter Valley Smelter To Resume

Rehabilitation of the Sumpter Valley smelter is assured, and the plant will be in operation the coming summer. This will offer a market for the complex ores of the Ben Harrison mine, which have not yielded to any other form of metallurgical treatment. The mine has a blocked-out tonnage of 90,000 tons of $10 gold ore.

JOPLIN-MIAMI DISTRICT

A Whistling Mine Drift

Something of a freak in the way of a musical mine is reported by T. F. Coyne, veteran mine operator of this district, in a property he recently opened up south of Hockerville, Okla. After a round of shots had been put off in one of the drifts on April 16, one of the miners, on returning to the face, was startled at hearing "some one whistling a pretty fair tune," as he expressed it, in the drift. He went back and got Mr. Coyne, and together they discovered that the noise was made by air coming in through crevices at the head of the drift. It was expected it would quickly die away, but it continued strong for several days, and at last accounts was still operating. Coyne says the "music" is a sort of cross between a calliope and the song of a canary bird. The mine, incidentally, is opening up with good prospects, and the new mill will be ready to commence regular operation about May 1.

Eagle-Picher Adds to Zinc Smelter

The Eagle-Picher Lead Co. is adding a new block to its five-block zinc smelter at Henryetta, Okla. It is also enlarging its gasoline absorption plant to a capacity of 5,000 gal., utilizing about 7,000,000 cu.ft. of gas daily.

NEVADA

Leadville Mines Finds Ore on 500 Level

The Leadville Mines Co., operating at Gerlach, has encountered ore on the 500 level only 18 ft. from the shaft, and the drift has been in commercial ore for about 50 ft. This vein produced above the 400 level, and there is every reason to expect to develop a large tonnage between the 400 and 500 levels. To the west the ore has not yet been discovered on the 500 level, but it should be cut soon. This ore was followed for over 900 ft. on the 400 level, with occasional shoots of richer ore, and has really been the big producer for the mine. It is said that there is now ore enough for several months' mill operation blocked out, and the 500 level ore will be in condition to mine before this upper level ore is exhausted. The flotation plant is in operation, treating from 50 to 60 tons per day.

Figures published for last year's operations show that mine production was 8,393 tons of ore, averaging 4.9 per cent lead and containing 24.26 oz. silver per ton. The gross value of concentrate shipped was $170,025.93. Average mill recovery was good.

Simon Silver Finds New Orebody

The Simon Silver-Lead mine will resume mill operations on May 1, as previously announced. Development is satisfactory; the 400 level crosscut has made connection to the old workings, and a south crosscut on the same level has opened a new orebody about 600 ft. west of the main orebody in undeveloped ground. The crosscut has been in ore for 25 ft., with only one wall exposed so far. The station on the 550 level has been completed, an east crosscut started, and work begun on the pump station. Surface construction is progressing satisfactorily. Joe Thorne, formerly with the Goldfield Consolidated in its prosperous days, is the superintendent.

Rochester Has Large Labor Turnover

March production for the Rochester Silver Corporation was 5,236 tons of ore. The average value was $10.66 per ton, and the gross value of the bullion produced was $51,959. This production can be regarded as normal. Mine development is satisfactory. The most important discovery is the finding of an oreshoot on the 550 level in the Kelaher vein. The vein has been drifted on for 60 ft. and shows a fair width of ore of better than average milling grade.

Labor conditions are said to be poor. The turnover has been large and the quality of available mine laborers is far from satisfactory.

MICHIGAN

New Headframe at Mary Charlotte

A new steel headframe is being erected at the Mary Charlotte mine of the Marquette Ore Co., at Negaunee, by the Worden-Allen Co. The new structure is being pieced together near the old wooden headframe, and will be moved into position when assembled. This will make unnecessary a suspension of operations.

Richmond and Maitland Mines Open

Preparations are being made at Palmer to resume operations at the Richmond and Maitland pit mines, which are worked only during the period of navigation. The Isabella, the one underground mine, has a large stock of ore awaiting transportation to the docks.

Large Shipments Anticipated

If the present warm weather continues, navigation will soon be opened on Lake Superior, and ore from the Marquette Range will be moving from the mines to the docks. The opening will be later than in 1922, but the season will probably open with a rush, as it is estimated that the mines will be called upon to furnish 60,000,000 tons this season.

Operations Are Resumed Near Iron River

The Forbes mine of Jones & Laughlin has resumed mining operations at Iron River following a two years' suspension. Only a small crew is employed, as there is a shortage of labor in the district. The Delta mine of the Sinclair company will be sending ore to the surface within a few weeks. This mine has also been idle for some time. It is believed that almost every mine in the Iron River field will be a shipper this year.

NEW YORK

Northern Ore Co. Contracts for New Shaft and Other Improvements

The Northern Ore Co., operating at Edwards, St. Lawrence County, has awarded a contract to the R. B. Kennedy Co. to sink a shaft 1,500 ft. deep at its property. This is to be a three-compartment vertical shaft and will be equipped with an Allis-Chalmers hoist of latest design. Three new 22,000-volt transformers have arrived at the plant, and a new power line is being constructed to the plant. The St. Lawrence Transmission Co. will furnish the necessary power. The concentrator is to be enlarged, and various improvements are to be made in its equipment to increase production.

A new pyrite mill has been planned to handle such pyrite as may be encountered in the handling of the zinc ore. The company is also erecting some good-sized houses to accommodate more workers.

At present the mine and mill are being worked to capacity and the trend of production is upward, so that all the improvements contemplated will be rushed through as fast as possible. W. R. Wade is manager.

THE MARKET REPORT

Daily Prices of Metals

Apr.	Copper, N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
19	16.625	43.375	44.50	8.00@8.125	7.90	7.00@7.15
20	16.625	43.125	44.125	8.00	7 85	6.95@7.10
21	16.625	44.00	44 00	8.00	7.85	6.95@7.10
23	16.50@16.625	44.125	45.125	8.00	7 825	6.95@7.10
24	16.50	44.50	45.50	8.00	7.75@7.85	6.95@7.10
25	16.50	43.50	44 625	7.85@8.00	7.75@7.85	6.90@7.05
Av.	16.573	43.604	44.646	7.998	7.838	7.025

*These prices correspond to the following quotations for copper delivered: April 19th, 20th, and 21st, 16.875c.; 23d, 16.75@16.875c.; 24th and 25th, 16.75c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. The quotations are for prompt deliveries. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

April	Copper Standard Spot	Copper Standard 3M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
19	73½	74⅜	81¼	208¾	209	26⅝	26⅞	34¼	34⅝
20	73	73⅞	81	207¾	208	26¼	26½	34	34¼
23	72⅞	73¾	81	212¾	212¾	26	26¼	33⅞	34
24	72¼	73	80⅞	215¾	215¾	26¼	26½	33⅝	33¾
25	72¼	73⅛	80½	210¼	210½	26	26⅛	32⅞	33

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Apr.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	Apr.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
19	4.65⅞	99⅝	66¾	32 5/16	23	4 64¾	99⅝	67	32 7/16
20	4.65⅜	99⅝	66⅜	32⅛	24	4.65	99⅝	67¼	32 9/16
21	4.65	99⅝	66½	32 3/16	25	4.64	99⅝	67⅝	32 11/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, April 25, 1923

The extreme dullness which has characterized the metal markets in recent weeks continues in even more accentuated form, with no buying of consequence in any metal. That producers are feeling this lack of demand is indicated by further price reductions, though there is no disposition to force large tonnages on an unwilling market, and most producers are well sold up with current production. The lowering of prices would probably not amount to much were it not for the fact that prices have dropped considerably in London. The increased unwillingness to buy on the part of local consumers is without doubt caused by the feeling that prices are tending downward rather than up, and that no more metal should be booked than is necessary for the needs of the immediate future.

Copper

Very few buyers have been interested in the offerings of producers, even at slight reductions in price. The larger interests are generally asking 17c. delivered, but this price is admittedly a nominal one. A little copper was sold last Thursday and Friday at 16¾c. delivered, and an occasional carload brought even as much as 17c., but on Monday and Tuesday offers at these prices brought no response whatever. A fair tonnage was sold yesterday at 16.75c., largely for June and July delivery, and yesterday and today offers of copper at this price have been rejected. Consumers are reported to have their copper requirements pretty well provided for up to July 1, so it would not be surprising to see the present dullness continue some weeks longer.

The export market showed some signs of life last week, owing to favorable fluctuations in exchange, but it is again very weak. Sales during the week have netted producers on this side about 17⅝c. for most of the business that has been done.

Lead

The official contract price of the American Smelting & Refining Co. was reduced on Thursday from 8.25c., New York, to 8c. This is the first reduction that has been made since June 22, 1921, when the price was established at 4.40c. The reduction was caused by the factors mentioned last week, namely, the decline in import costs, and the fact that lead was being offered by others at the 8c. level, late Wednesday afternoon.

The decline in price has scared buyers off and sales have been the smallest reported in years. The new 8c. price has been largely a nominal figure, with bookings almost entirely confined to contract business. As London has declined further, the specter of imported lead is again hovering over the market, with import costs but little above 7.50c., c.i.f. New York. This has resulted today in offerings at concessions from the 8c. level, for delivery in June. There is a little April lead available but the premium has largely disappeared. Any amount of May lead is available at 8c.

In St. Louis the market is also decidedly weaker, with more pressure to sell than has been evident for some weeks. It would seem that some metal accumulated at higher levels is now being thrown on an unwilling market in an effort to get rid of it before the price goes still lower.

As mentioned last week, the present price recession is occasioned almost entirely by the declines abroad, which in turn have been caused by troubles in the building industry in England and upset political conditions and unfavorable exchange rates on the Continent. Domestic consumption continues unabated, and is almost sure to prevent any violent price decline. Buying must soon resume. The cessation of purchases of silver under the Pittman Act will no doubt cause somewhat less lead ore to be mined after July.

Zinc

Galvanizers continue out of the market and the brass mills are also not active buyers, though the higher grades of zinc are in fair demand. Brass special has sold for about 7.75c., New York, and high-grade has declined to about 8.50@8.75c. delivered in the East. Continued declines in London have caused the further recessions here, though there has been little pressure of metal on the market. Today prices range from about 7.05c. for prompt Prime Western zinc to discounts of about 5 points for each month forward.

Tin

There was some activity between dealers in the middle of the week but consumers remain disinterested, and prices are still well below import costs. It is said that the local smelter of the Williams Harvey Corporation will close down at an early date and it would not be surprising to see similar action by the American Smelting & Refining Co., the only other American smelter at present, for local smelting costs are too much above those in England. Tin for forward delivery has been about one-half cent above the spot prices.

Arrivals of tin, in long tons: April 17th, China, 50; Liverpool, 50; 20th, Australia, 30; Straits, 600; China, 5; 21st, Straits, 75; 23d, London, 50; Straits, 90; Java, 200; 24th, Liverpool, 125. Total so far in April, 6,294.

Gold

Gold in London: April 19th, 88s. 7d.; 20th, 88s. 5d.; 23d, 88s. 8d.; 24th, 88s. 8d.; 25th, 88s. 8d.

Foreign Exchange

On Tuesday, April 24, cable quotations on francs were 6.74c.; lire, 4.955c.; marks, 0.0032⅛c.; and Canadian dollars, 1⅛ per cent discount.

Mexican Dollars—April 19th, 51; 20th, 50⅝; 21st, 50⅝; 23d, 51⅛; 24th, 51⅛; 25th, 51⅝.

Silver

Continued buying by China and the Indian bazaars has caused a further advance in price since last week. The market closes quiet.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—General market for 99 per cent grade, 27c. per lb.; 98 per cent, 26c. London, £105@£115.

Antimony — Chinese and Japanese brands, 8@8¼c. W.C.C., 8½@9c. Cookson's "C" grade, spot, 10@10½c. Chinese needle antimony, lump, nominal, 6c. per lb. Standard powdered needle antimony, 200 mesh, at 6½@7c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 8¼@9c.

Bismuth—$2.55 per lb. London, 10s.

Cadmium—$1@$1.10 per lb. London, 5s.@5s. 3d.

Iridium—$260@$275 per oz.

Nickel—28@30c. per lb. for 99 per cent virgin metal. London, £130 per long ton.

Monel Metal—Shot and blocks, 32c. per lb.; ingots, 38c.; f.o.b. W. Va.

Palladium—$79 per oz.

Platinum — $116 per oz. London, sponge, £22.

Quicksilver—$69 per 75-lb. flask. San Francisco wires $69.65. London, £10 10s.

The **prices of Cobalt, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tellurium, and Thallium** are unchanged from prices given April 7.

Metallic Ores

Chrome Ore—Indian chrome ore, $20.50 per ton, c.i.f. Atlantic ports. New Caledonian, $24@$26 per ton. Rhodesian, $20@$22.

Manganese Ore—40@45c. per long ton unit, seaport, plus duty.

Molybdenum Ore—75@85c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates.

Tungsten Ore — Wolframite, $8@$8.50; scheelite, $8.50@$9 per unit of WO_3, f.o.b. New York.

Iron Ore, Magnetite, Tantalum, Titanium, Uranium, Vanadium, and **Zircon Ore** are unchanged from the quotations published April 7.

Zinc and Lead Ore Markets

Joplin, Mo., April 21—Zinc blende, per ton, high, $49.75; basis 60 per cent zinc, premium, $44@$46.50; Prime Western, $40@$42.50; fines and slimes, $42.50@$40; average settling price, $45.72. Calamine, basis 40 per cent zinc, $26; average, $28 per ton.

Lead, high, $121.45; basis 80 per cent lead, $115@$110; average settling price, $116.12 per ton. The high price and the high average are occasioned by shipments of ore contracted on a $120 basis.

Shipments for the week: Blende, 14,693; calamine, 142; lead, 1,734 tons. Value, all ores the week, $877,170.

Some buyers picked up a few hundred tons of blende on a basis of $40 for Prime Western grades, but the ruling price was $41.50@$42.50. An especial demand for lead-free zinc ore sent this grade to $46.50, or $2 higher than ore purchased for rolled zinc, which was purchased on $44.50 basis, usually the highest basis offering. Purchases totaled 12,050 tons—nearly 2,000 tons more than last week.

Platteville, Wis., April 21.—Blende, basis 60 per cent zinc, $46 per ton. Lead, basis 80 per cent lead, $115 per ton. Shipments for the week: Blende, 457 tons; lead, none. Shipments for the year: Blende, 9,578; lead 220 tons. Shipments for the week to separating plants: 871 tons blende.

Non-Metallic Minerals

Asbestos—Crude No. 1, $500; No. 2, $250@$325; long spinning fibers, $135@$200; magnesia and compressed sheet fiber, $100@$150; shingle stock $65@$85; paper stock, $35@$42; cement stock, $20@$25; shorts, $9@$14—all per short ton, f.o.b. mines, Quebec, Canada.

Fluorspar — Enameling grades, uncrushed, $19 per ton, f.o.b. New York. Acid grades, 98½ per cent or better, crushed, $27.50 delivered. For other fluorspar prices see issue of April 7.

Bauxite, Barytes, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Manjak, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, Sulphur, and **Tripoli** are unchanged from the April 7 prices.

Mineral Products

Arsenious Oxide (white arsenic)—13½@14½c. per lb. for prompt. June, 12½c. Second half 1923, 11c.

Copper Sulphate—Large crystals, 6.25c.; small, 6.15c.

Potassium Sulphate, Sodium Nitrate, and **Sodium Sulphate** are unchanged from quotations of April 7.

Ferro-Alloys

Ferromanganese — Domestic, 78@8[illegible] per cent, $120 per gross ton, f.o.b. furnace. Spiegeleisen, 19@21 per cent, $40, f.o.b. furnace; 16@19 per cent, $39.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium, and **Ferrovanadium** are unchanged from the prices published April 7.

Metal Products

Copper Sheets—Base price 25½c. per lb. Wire, 19§c.

Lead Sheets—Full, $10.25; cut, $10.50 per 100 lb.

Zinc Sheets—Base price, $10 per 100 lb., East St. Louis.

Nickel Silver and **Yellow Metal** are unchanged from prices given in the April 7 issue.

Refractories

Bauxite Brick, Chrome Brick, Chrome Cement, Magnesite Brick, Magnesite Cement, Silica Brick and **Zirkite** are unchanged from the April 7 prices.

The Iron Trade

Pittsburgh, April 24, 1923

The Steel Corporation has advanced its prices on tubular goods about $4 a net ton, independents immediately following, and wire nails $2 a ton to $3 a keg, following advances already made by independents.

Steel production is well maintained. Though the market in general is in less excited condition, the turnover continues large. One influence is that a number of independents are now more ready to sell freely for third-quarter delivery.

Pig Iron—The quietness in the pig-iron market has developed into stagnation. Producers are comfortably sold and consumers comfortably covered, for a time, and the question is which will have to come into the market first. Bessemer, basic, foundry, and malleable have all been quotable at $31, Valley, for more than a month.

Connellsville Coke—Spot furnace remains at $6@$6.50. Spot foundry has declined 50c. to $7@$7.50. Furnace coke for the rest of the quarter has sold at $6.50, against $7@$7.25 done on the bulk of the business closed a few weeks ago for the quarter.

Germany's Copper Consumption Likely to Decrease This Year

SPECIAL FOREIGN CORRESPONDENCE

In 1922 Germany recovered her position as the world's second largest copper consumer. The electrical industry, which absorbs 70 per cent of the country's total consumption, was extremely busy all year on export and domestic business. Considerable quantities of copper were also used by the post and railway administration for reconstruction and extension purposes. The use of war substitutes has almost ceased. New and more suitable substitutes have made no headway. The hopes built upon aluminum, which is now produced in quantities exceeding the domestic demand, have so far been disappointed.

Imports of copper in 1922 made a further advance, as shown by the following figures:

	Metric Tons
1920	50,500
1921	105,500
1922	127,900

Compared with pre-war years, this import amounts to 57 per cent of that of 1913 and 67 per cent of the import in 1912. Besides the United States, which contributed about 84 per cent to the total, the main countries of origin were Belgium and Great Britain, which supplied 4,485 and 2,867 metric tons respectively.

The forecast of the situation in the current year is largely dimmed by the Ruhr occupation, which has had serious consequences to business. The market had already been weakening before the Ruhr occupation took place. The momentum of the decline is since then increasing at an alarming rate. Financial conditions also are a formidable barrier to the progress of business, tending as they do toward close retrenchment. A drop of the copper import is quite certain. The industry is still fully employed on orders in hand, but the total of the year will assuredly remain considerably below that of last year. It seems likely that the import in 1922 will remain a high-water mark for several years to come.

Mining Dividends for April

The following dividends were paid by mining and metallurgical companies during April:

Companies in the United States	Situation	Per Share	Total
Anaconda Copper	Mont.	$0.75	$2,250,000
Bethehem Stee. "B"	U. S.	1.25Q	845,106
California Rand Silver	Calif.	0.02	25,600
Cresson Consolidated Gold	Colo.	0.10Q	122,000
Eagle Picher Lead, pfd.	Mo., Okla.	1.50Q	15,000
Great Northern Iron Ore	Minn.	1.00SA	1,500,000
Homestake Mining, g.	S. D.	0.50M	125,580
Inspiration Consolidated Copper	Ariz.	0.50	590,983
Iron Blossom Consolidated, s. c. l.	Utah.	0.025	25,000
Kennecott Copper	Alaska	0.75Q	2,090,341
Miami Copper	Ariz.	0.50Q	373,557
Park City, s. l. z.	Utah.	0.125Q	109,500
Park Utah, s. l.	Utah.	0.15	150,000
Phelps Dodge, c.	U.S. and Mexico	1.00Q	500,000
Republic Iron & Steel pfd.	U. S.	1.75	437,500
Silver King Coalition, s. l. z.	Utah.	0.15Q	182,415
Sloss-Sheffield Steel & Iron pfd.	Ala.	1.75	117,250
Tonopah Belmont Dev., s. g.	Nev.	0.05Q	75,000
Tonopah Extension, s. g.	Nev.	0.10QX	139,272
Tonopah Mining, s. g.	Nev.	0.075Q	75,000
United Eastern, g.	Ariz.	0.15Q	204,450
U. S. Smelting, Ref.& Mng. pfd., s.l.	U.S. and Mexico	0.875Q	425,556
Companies in other countries			
Asbestos Corporation	Que.	1.50Q	45,000
Asbestos Corporation pfd.	Que.	1.75Q	70,000
Dolores Esperanza, g. s.	Chi., Son.	0.05Q	43,241
Dome Mines, g.	Ont.	0.50Q	238,333
Erupcion Mining, s.l.	Chi.	0.125QX	156,250
Hollinger Consolidated Gold	Ont.	0.05—4 wks	246,000
Kerr Lake, s.	Ont.	0.125Q	75,000
N. Y. & Honduras Rosario, g. s.	Honduras	0.25Q	50,000
Nipissing, s.	Ont.	0.15Q	180,000
Premier Gold	B. C.	0.10Q	500,000
Silversmith Mines, s. l. z.	B. C.	0.01	25,000
Wright-Hargreaves, g.	Ont.	0.025Q	68,750

Q, quarterly; M, monthly; X, includes 5c. extra; g, gold; s, silver; c, copper; l, lead; z, zinc; SA, semi-annually.

Many companies are resuming payments in April. These include, among the more important companies, Anaconda, whose last payment was $1 in November, 1920; Inspiration, Republic Iron & Steel, and Sloss-Sheffield Steel.

Companies whose dividends are not recorded in these columns are invited to advise us when payments are to be made.

Facts for the Stockholder

XV—Magma Copper Co.

THE MAGMA COPPER CO. was incorporated in Maine, in May, 1910. It owns 1,915 acres of mining claims, of which 520 acres are patented; 403 acres of adjoining mill sites, of which 31 acres are patented; and 262 acres of patented ranch lands near the mill sites; all in the neighborhood of Superior, Ariz. It owns also practically the entire capital stock of the Magma Arizona Railroad Co., owning and operating a 31-mile railway from Superior to Magma Junction, on the Arizona Eastern Ry. This railroad has been broad-gaged and regraded. Furthermore, it owns $250,000 par value of the capital stock of the Patagonia Superior Copper Co. and $10,200 par value of the stock of the Apache Powder Co.

The orebodies of the mine occur in a porphyry-filled fault fissure cutting through diabase, quartzite, and limestone. The ore is chiefly chalcocite, chalcopyrite, and bornite. The mine is developed by three shafts, 800 ft., 2,000 ft., and 2,500 ft. deep, with levels at 100-ft. intervals. In the upper levels, the oreshoot is 5 to 8 ft. wide and 300 to 500 ft. long. On the 1,800 level, the deepest level on which the orebody is completely developed, the shoot is 1,550 ft. long and 20 ft. wide, and assays 5.72 per cent copper and 2.64 oz. silver. On the 2,000 level, which is being driven, the oreshoot has been developed for a length of 1,000 ft., with an average width of 21.8 ft., and assaying 8.56 per cent copper, and 4.5 oz. silver.

Reasonably assured ore reserves are estimated at 1,505,000 tons, assaying 5.6 per cent copper, 3 oz. silver, and 50c. gold. The reserves now developed are sufficient for about seven years' operations with a production of 600 tons per day. This is more than is usually developed ahead of requirements in a vein mine of this type. Some of the last crosscuts driven on the 2,000 level have disclosed considerable chalcocite and gray copper.

The capacity of the concentrator has been increased from 300 to 600 tons a day, by installation of more fine-grinding machinery and enlargement of the flotation equipment. The company is building its own smelter at Superior, and estimates that it will be able to produce blister copper for 2c. per lb. less than by shipping to the Hayden smelter, 82 miles from the mine. The new smelter will probably be in operation sometime during the first half of 1924. On the basis of 600 tons daily of sulphide ore and 25 tons of carbonate ore, the monthly production of copper should be about 2,000,000 lb., at a cost under 9c. a pound, before depreciation, but after allowing due credit for gold and silver.

Authorized capital stock is 350,000 shares of no par value, of which 240,000 shares are outstanding. On April 6, 1922, the board of directors authorized the issue of $3,600,000, ten-year, 7 per cent, convertible debenture bonds, dated June 1, 1922, and convertible at any time after issue into stock on a basis of 15 shares of stock for each $500 bond. Stockholders of record on May 12, 1922, were given the right to subscribe to the bonds at par on the basis of $1,500 bonds for each 100 shares of stock. On June 16, 1922, it was announced that the shareholders had taken the entire issue.

Production in millions of pounds copper has been as follows: 1.4 in 1913, 2.2 in 1914, 6.0 in 1915, 8.5 in 1916, 10.1 in 1917, 10.9 in 1918, 9.7 in 1919, 8.8 in 1920, 2.0 in 1921. The mine was shut down in March, 1921, and resumed operations in April, 1923.

Earnings have been as follows: $2.55 a share in 1915, $4.56 in 1916, $4.44 in 1917, $2.16 in 1918, 75c. in 1919, 42c. in 1920, a loss of $1.25 in 1921. The initial quarterly dividend of 50c. a share was paid Sept. 30, 1915. The dividend record is: $1 a share in 1915, $2 in 1916, $2.10 in 1917, $1.50 in 1918, and 50c. in 1919.

Assets applicable to the capital stock amount to about $15 a share. Net working capital at the end of 1921 was about $2.70 a share.

Price range of stock since listing on the New York Stock Exchange has been as follows: High, 38¼ in 1923; low, 27 in 1922; closing price, 34⅜, April 24, 1923. INVESTIGATOR.

COMPANY REPORTS

American Zinc, Lead & Smelting Co.

A report of the operations of the American Zinc, Lead & Smelting Co. for 1922 shows a profit of $443,237.27, according to the following account:

Profits from operations, being the result of the sales of zinc and lead ores, sales of spelter, pig lead, zinc oxide, limestone and sulphuric acid, receipts from royalties, after deducting all cost of mining, manufacture, marketing ores, spelter, pig lead, zinc oxide, limestone and sulphuric acid, other expenses of operation and all administrative, general and selling expenses and taxes	$516,313.18
Deduct interest on bonds, less interest on bank deposits	73,075.91
Total profit	$443,237.27
Adjusted surplus at Dec. 31, 1921	2,010,135.13
	$2,453,372.40
Deduct Transferred to depletion and depreciation reserves	421,337.59
Surplus at Dec. 31, 1922	$2,032,034.81

Balance sheet of the report, as of Dec. 31, 1922, is as follows:

Assets

Property account:		
At Dec. 31, 1921	$12,505,956.14	
Additions, less sales, during year 1922	100,597.55	
		$12,606,553.69
Investments		1,875,008.61
Cash in sinking fund for retirement of bonds		2,262.18
Current assets		
Ore stocks	$751,851.18	
Spelter, pig lead, zinc oxide and sulphuric acid stocks	175,662.67	
Inventories of materials and supplies	747,755.46	
Cash	139,365.62	
Notes receivable	74,624.51	
Accounts receivable, trade	647,514.69	
Accounts receivable, other	91,456.77	
Advance to Wisconsin Zinc Co.	40,000.00	
		2,668,230.90
Deferred charges to operations		151,459.33
		$17,303,514.71

Liabilities

Capital stock issued			
	Shares	Par Value	
Preferred stock	96,560	$25.00	$2,414,000.00
Common stock	193,120	25.00	4,828,000.00
			$7,242,000.00
First mortgage 5 per cent ten-year gold notes			
At Dec. 31, 1921	$1,370,900.00		
Less retired through sinking fund	114,100.00		
			$1,256,800.00
Reserves for depletion, depreciation, insurance, and sundries			6,308,081.30
Current liabilities			464,598.51
Surplus			2,032,034.81
			$17,303,514.71

Capital expenditures, less credits from sales of property, amounted to $100,597.55 for the year and cover in large part projects upon which work had been suspended temporarily in the fall of 1920. The most important of these were the construction of ore-roasting plant (not yet completed) to operate as an auxiliary to the zinc oxide plant at Columbus, Ohio; extension of the zinc-oxide plant at Hillsboro, Ill., and the construction of a 66 deg. sulphuric acid concentrating plant at East St. Louis, Ill.

Investments were increased by $402,551.41, representing additional investment in the Silver Dyke property and loans to the Silver Dyke Mining Co. for the purpose of constructing a mill. It was stated in last year's report that if developments at the Silver Dyke property were favorable, they would be followed by the erection of a concentrating plant, and as these developments were favorable, the mill has been constructed and is now in operation. The Silver Dyke mine gives promise of considerably greater tonnage and of returns substantially greater in amount than were estimated at the time that the decision to build the mill was made.

Barnes-King Development Co.

Gold; Montana

A report of operations of Barnes-King Development Co. for 1922 shows a loss of $53,447.10 according to the following account:

General Profit and Loss Account

Loss on operation of Shannon property		$6,934.84
Loss on operation of North Moccasin and Kendall Power Plant		6,501.79
Loss on operation of Strawn Option		13,794.47
Loss Piegan-Gloster property		6,626.68
Total property losses		$33,857.78
Total miscellaneous income		4,370.91
Loss on property operations in excess of miscellaneous income		$29,486.87
Expenses		
Strawn option	$13,256.23	
Black Hawk Option	500.00	
Whittley group development	656.36	14,412.59
Examination of new properties		2,228.71
Taxes Paid:		7,318.93
Net loss for 1922, carried to balance sheet		$53,447.10

Balance sheet as of Dec. 31, 1922 is given as follows:

Assets

Fixed		$1,779,910.89
Deferred		37,792.91
Current		181,471.34
Total assets		$1,999,175.14

Liabilities and Capital

Capital Stock		
400,000 shares at a par value of $5 per share		$2,000,000.00
Surplus		
Balance, Dec. 31, 1921	$70,669.78	
Deduct depletion for 1921 and depreciation adjustments	30,943.75	
Balance after adjustments Dec. 31, 1921	$39,726.03	
Net loss for 1922	53,447.10	
Deficit		13,721.07
Current liabilities		
Unpaid wages of Dec., 1922 (Paid in Jan., 1923)	$7,732.63	
Accounts payable (Paid in Jan., 1923)	5,163,58	
		12,896.21
Total liabilities and capital		$1,999,175.14

Homestake Mining Company

Gold; South Dakota

A report of the operations of the Homestake Mining Co. for 1922 shows dividends of $879,060 paid, of which $85,627.26 was taken from depletion reserve. During the year 1,663,485 tons of ore was milled, realizing an average of $3.7784 per ton. Balance sheet as of Dec. 31, 1922, is given as follows:

Assets

Mines, hoisting works, stamp mills, regrinding plant, cyanide plants, compressor plants, pumping plants, electric lighting and power plants, timber lands, assay office, buildings, refining plant, machine shop, foundry, water rights and franchises	$29,109,758.01
Balance in banks	905,620.06
Balance with superintendent	51,803.59
Bullion in transit	263,492.33
U. S. Government Bonds, $1,000,000 par value	999,750.31
Accounts receivable	4,462.93
General supplies as per inventory, Jan. 1, 1923	543,186.99
Profit and loss account	981,519.18
	$32,859,413.40

Liabilities

Capital stock—251,160 shares at $100,000	$25,116,000.00
Outstanding drafts	256,044.39
Accounts payable	114,058.25
Unclaimed dividends	5,100.96
Reserve for depreciation and depletion	7,368,209.80
	$32,859,413.40

North Star Mines Co.

Gold; Green Valley, California

A report of the operations of the North Star Mines Co. for 1922 shows a loss of $249,938.70 after depletion, depreciation, and an option loss. Financial statement follows:

Receipts

Balance at end of 1921		$998,586.89
Production, North Star mine		
Tons mined, 154,129; crushed 115,600.		
Mill (amalgamation)	$899,198.24	
Cyanide plant	188,507.75	
		$1,087,705.99
Champion Mines		
Improvement account; salvaging		4,400.00
Homes purchase account		1,652.58
Lime and limestone account		1,250.00
Interest and dividends received		41,762.91

Disbursements

Operating expenses North Star mine			$808,260.32
Development expenses			
North Star mine (9,128 ft.)			132,217.72
Total operating and development			$940,478.04
Champion mines			
Operating expenses		$5,104.63	
Proceeds of old material sold	$2,276.36		
Expenses	300.00	1,976.36	
			3,128.27
Improvement			
North Star			
Central shaft			1,724.50
Property purchase North Star			324.80
Development of mining properties under option			
West Point	$38,182.84		
Rainbow	60,000.00		
			98,182.84
Dividend (No. 59) 2 per cent			50,000.00
Balance, Dec. 31, 1922			1,041,519.92
			$2,135,358.37

Balance sheet as of Dec. 31, 1922, is given as follows:

Assets

Mining property		$3,485,421.25	
Less amount written off for depletion		3,286,681.45	
			$198,739.80
Homes purchase			6,132.35
Lime and limestone account			1,250.00
Plant and equipment		$1,338,072.48	
Less net proceeds of materials salvaged at Champion Mines		19,934.25	
		$1,318,138.23	
Less amount written off for depreciation		1,079,356.59	
			$238,781.64
Rainbow option			90,005.00
Cash investments			1,041,519.92
Total assets			$1,576,428.71
Deficit, as per surplus account			598,571.29
			$2,175,000.00

Liabilities

Capital stock (250,000 shares at $10)		$2,500,000.00
Less dividends Nos. 55-59, distribution of capital assets		325,000.00
		$2,175,000.00

Surplus Account

Deficit, Dec. 31, 1921			$348,632.59
Profit and loss, year 1922.			
Production		$1,087,705.99	
Interest and dividends		41,762.91	
		$1,129,468.90	
Operating and development	$943,606.31		
Depletion of mines	231,200.00		
Depreciation of plant and equipment	27,594.91		
West Point option written off as loss	177,006.38	1,379,407.60	
Loss			249,938.70
Deficit, carried to balance sheet			$598,571.29

Production was $9.409 per ton crushed. Total costs were $8.136 per ton.

Shattuck Arizona Copper Mining Co.

Copper; Bisbee, Arizona

A report of operations of Shattuck Arizona Copper Mining Co. for 1922 shows that no copper was produced during the year. Gross income from interest and miscellaneous receipts amounted to $37,993.56, and expenses were $64,912.28, leaving a loss of $26,918.72, to which a reserve of $2,005.91 was added for depreciation. Surplus Dec. 31, 1921, was $284,693.65; on Dec. 31, 1922, it was $209,204.67.

U. S. Smelting, Refining & Mining Co.

A report of the operations of the U. S. Smelting, Refining & Mining Co. for 1922 shows a profit of $3,511,217.41, according to the following account:

Earnings of all companies, after charging cost of production, selling expenses, repairs, and interest, but before providing for depreciation, depletion and federal taxes			$5,112,584.11
Profit from other sources			626,330.65
			$5,738,914.76
Deduct			
Reserves for depreciation and depletion	$1,610,447.99		
Reserves for federal taxes and other purposes	617,249.36		
			2,227,697.35
Profits for year 1922 as per consolidated balance sheet			$3,511,217.41
Undistributed surplus, as per previous balance sheet			$16,534,938.42
Profits for 1922, as above			3,511,217.41
			$20,046,155.83
Less additional reserves	$1,600,000.00		
Dividends on preferred stock	1,702,225.00		3,302,225.00
Undistributed surplus as per balance sheet			$16,743,930.83

Balance sheet as of Dec. 31, 1922, is given in the report as follows:

Assets

Capital assets			
Property and investment account, as per last balance sheet	$74,982,443.01		
Add adjustment	659,322.14		
		$75,641,765.15	
Additions during the year		1,561,117.20	
		$77,202,882.35	
Deduct			
Deserves for depreciation, depletion and amortization		17,132,456.18	
Capital assets at net book values			$60,070,426.17
Improvements, options and other deferred charges	$2,352,490.32		
Less reserves for contingencies	1,064,058.25		1,288,432.07
Current assets			
Inventories	$8,439,575.00		
Stocks and bonds	1,829,946.51		
Notes receivable and loans	423,291.42		
Accounts receivable	2,693,671.51		
Cash	2,353,151.84		
Total			15,739,636.28
			$77,098,494.52

Liabilities

Capital liabilities			
Capital stock			
Common			$17,555,887.50
Preferred			24,317,775.00
Total issued			$41,873,662.50
Capital stocks of subsidiary companies not held by U. S. S. R. & M. Co. and proportion of profit-and-loss accounts applicable to minority stocks			2,147,397.35
Funded debt			
U. S. S. R & M. Co. ten year 6 per cent convertible gold notes due Feb. 1, 1926	$12,000,000.00		
Bonds of subsidiary companies not owned in consolidation	289,500.00		
			12,289,500.00
Total capital liabilities			$56,310,559.85
Current liabilities			4,044,003.84
Profit-and-loss account			
Balance at Dec. 31, 1921		$16,534,938.42	
Profit for year 1922		3,511,217.41	
		$20,046,155.83	
Less			
Additional reserves	$1,600,000.00		
Dividends on stocks of U. S. S. R. & M. Co.: preferred at 7 per cent per annum	1,702,225.00		
		3,302,225.00	16,743,930.83
			$77,098,494.52

The metals and byproducts produced in 1922 from ores extracted at the company's mines in the United States and in Mexico and from custom ores, and the coal production in Utah, were as follows:

		Percentage in Value of Each Product
Copper, lb	3,202,575	1.6
Lead, lb	65,916,512	14.9
Zinc, lb	2,004,801	.4
Silver, oz	19,736,742	55.9
Gold, oz	128,319	9.9
Byproducts and miscellaneous		2.6
Coal, tons	1,165,998	14.7
		100.0

MINING STOCKS

Week Ended April 21, 1923

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	78	75	75	Mar. 23, Q	$1.00
Alaska-Br. Col.	N. Y. Curb	2¼	2	2	.....	....
Allouez	Boston	27½	27	27	Mar. '19	1.00
Anaconda	New York	50	48½	48⅝	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2¼	2¼	2¼	.....	....
Ariz. Com'l.	Boston	13⅜	13	13⅜	Oct. '18, Q	0.50
Calaveras	N. Y. Curb	3⅜	3⅜	3⅜	.....	....
Calumet & Arizona	Boston	60½	58	58½	Mar. '23	1.00
Calumet & Hecla	Boston	365	354	360	Mar. '23, Q	7.00
Canada Copper	N. Y. Curb	...	...	*4	.....	....
Centennial	Boston	10	10	10	Dec. '18, SA	1.00
Cerro de Pasco	New York	49½	46½	46½	Mar. '21, Q	0.50
Chile Copper	New York	28⅛	27⅛	28	Mar. 23,	0.625
Chino	New York	28⅛	27	27⅜	Sept. '20, Q	0.37
Copper Range	Boston	40½	39½	39½	Mar. '22, Q	1.00
Crystal Copper	Boston Curb	1⅞	1⅞	1 15/16	.....	....
Davis-Daly	Boston	3⅜	3⅛	3⅛	Mar. '20, Q	0.25
East Butte	Boston	8⅜	8⅛	8¼	Dec. '19, A	0.50
First National	Boston Curb	*55	*50	*55	Feb. '19, SA	0.15
Franklin	Boston	1⅛	1⅛	1⅛	.....	....
Gadsden Copper	N. Y. Curb	*70	*70	*70	.....	....
Granby Consol.	New York	31⅛	29½	29⅜	May '19, Q	1.25
Greene-Cananea	New York	29	28	28⅜	Nov. '20, Q	0.50
Hancock	Boston	3	3	3	.....	....
Howe Sound	N. Y. Curb	3⅛	3⅛	3⅛	Jan. '21, Q	0.05
Inspiration Consol.	New York	39⅛	37⅛	38	Apr. '23, Q	0.50
Iron Cap	Boston Curb	7⅛	7⅛	7⅛	Sept. '20, K	0.25
Isle Royale	Boston	28⅜	27⅜	28	Mar. '23, Q	0.50
Kennecott	New York	41⅜	40⅛	40⅛	Apr. '23, Q	0.75
Keweenaw	Boston	1⅛	1⅛	1⅛	.....	....
Lake Copper	Boston	4⅛	3⅝	4	.....	....
Magma Copper	New York	37	34⅛	34⅛	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	2⅜	2⅜	2⅜	.....	....
Mass Consolidated	Boston	3	3	3	Nov. '17, Q	1.00
Miami Copper	New York	30	29⅛	29⅜	Apr. '23, Q	0.50
Michigan	Boston	1⅛	1⅛	1¼	.....	....
Mohawk	Boston	60⅛	58	58	Mar. '23, Q	1.00
Mother Lode Con.	New York	11⅛	10⅝	11	Mar. '23, K	0.50
Nevada Consol.	New York	15⅛	15	15⅜	Sept. '20, Q	0.25
New Cornelia	Boston	21	19⅜	19⅜	Feb. '23, Q	0.25
North Butte	Boston	10	9⅛	10	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*94	*83	*83	.....	....
Old Dominion	Boston	28⅛	27	27	Dec. '18, Q	1.00
Osceola	Boston	36	34¾	36	Mar. '23, K	1.00
Phelps Dodge	Open Mar.	†190	†180	...	Apr. '23, Q	1.00
Quincy	Boston	44	43⅛	44	Mar. '20, Q	1.00
Ray Consolidated	New York	15⅛	14⅛	15⅛	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1⅛	1⅛	1⅛	.....	....
St. Mary's Min. Ld.	Boston	48⅛	47	47	Mar. '23, K	3.00
Seneca Copper	Boston	10⅛	8	8	.....	....
Shannon	Boston	*80	*80	*80	Nov. '17, Q	0.25
Shattuck Arizona	New York	9⅛	9	9⅛	Jan. '20, Q	0.25
South Lake	Boston	...	...	*50	.....	....
Superior & Boston	Boston	2⅛	2	2	.....	....
Tenn. C. & C. cfs.	New York	11⅜	11	11	May '18, I	1.00
Tuolumne	Boston	*45	*42	*42	May '13,	0.10
United Verde Ex.	N. Y. Curb	38⅛	36⅜	37⅛	Nov. '22, Q	0.25
Utah Consol.	Boston	2¼	2	2	Sept '18,	0.25
Utah Copper	New York	72⅛	70	70⅜	Mar. '23, Q	1.00
Utah Metal & T.	Boston	1	*98	*98	Dec. '17,	0.30
Victoria	Boston	....	....	1⅛	.....	....
Winona	Boston	1	*85	*85	.....	....
Wolverine	Boston	8⅛	8⅛	8⅛	.....	....
NICKEL-COPPER						
Internat. Nickel	New York	14⅛	14⅛	14⅛	Mar. '19,	0.50
Internat. Nickel, pfd.	New York	76	75⅛	76	Feb. '23, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	4⅛	4⅛	4⅛	.....	....
National Lead	New York	131	127	127⅛	Mar. '23, Q	2.00
National Lead, pfd.	New York	111⅛	111⅛	111⅛	Mar. '23, Q	1.75
St. Joseph Lead	New York	21⅛	20¼	20⅜	Mar. '23, Q, X	0.50
ZINC						
Am. Z. L. & S.	New York	16⅛	15⅛	15⅛	May '20,	1.00
Am. Z. L. & S. pfd.	New York	54	53	53	Nov. '20, Q	1.50
Butte C. & Z.	New York	9⅞	8	8⅜	Mar. '23,	0.50
Butte & Superior	New York	33	31⅛	31⅛	Dec. '22,	0.50
Callahan Zn-Ld	New York	9⅜	8⅞	8⅛	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	177	175	175	Feb. '23, Q	2.00
United Zinc	N. Y. Curb	*90	*90	*90	.....	....
Yellow Pine	Los Angeles	*68	*65	*65	Sept. '20, Q	0.03
SILVER						
Alvarado	N. Y. Curb	5⅛	5⅛	5⅛	.....	....
Batopilas Mining	New York	....	....	⅜	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*46½	*45	*45	May '20, K	0.03
Candelaria	N. Y. Curb	*19	*15	*16	.....	....
Castle-Trethewey	Toronto	*28	*27	*28	.....	....
Coniagas	Toronto	3	3	3	May '21, Q	0.12½
Crown Reserve	Toronto	*74	*67½	*72	Jan. '17,	0.05
Hilltop-Nev.	N. Y. Curb.	1¼	1 1/16	1 1/16	.....	....
Kerr Lake	N. Y. Curb	3	3	3	Apr. '23, Q	0.12½
La Rose	Toronto	*29	*27½	*28	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*22	*20	*22	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	3.25	3.00	3.25	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	5⅞	5⅛	5⅞	Apr. '23, Q	0.15
Ontario Silver	New York	....	....	6½	Jan. '19, Q	0.50
Temiskaming	Toronto	*48	*46½	*47	Jan. '20, K	0.04

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	¼	¼	¼	.....	....
Alaska Juneau	New York	1⅛	1⅛	1⅛	.....	....
Carson Hill	Boston	7	7	7	.....	....
Cresson Consol. G.	N. Y. Curb	3¼	3	3¼	Apr. '23 Q	0.10
Dome Mines	New York	42⅛	41½	42⅛	Apr. '23, Q	0.50
Golden Cycle	Colo. Springs	1.11½	1.11½	1.11½	Dec. '22, Q	0.02
Hollinger Consol.	Toronto	13.50	13.25	13.50	Apr. '23, M	0.05
Homestake Mining	New York	69⅝	69½	69⅝	Mar. '23, M	0.50
Kirkland Lake	Toronto	*60	*58	*58½	.....	....
Lake Shore	Toronto	3.40	3.38	3.38	Nov. '22, Q	0.02
McIntyre- Porcupine	New York	19⅛	18⅝	18⅝	Jan. '23, K	0.25
Portland	Colo. Springs	*32	*32	*32	Oct. '20, Q	0.01
Teck Hughes	N. Y. Curb	1 3/16	1 1/16	1⅛	.....	....
Tom Reed	Los Angeles	*96	*93	*95	Dec. '19,	0.02
United Eastern	N. Y. Curb	2⅛	1 1/16	2	Jan. '23, Q	0.15
Vipond Cons.	Toronto	*76	*66½	*76	.....	..
White Caps Mining	N. Y. Curb	...	...	*9	.....	....
Wright-Hargreaves	Toronto	3.57	3.57	3.57	Apr. '23,	0.02½
Yukon Gold	N. Y. Curb	2	1⅞	1 15/16	June '18,	0.02½
GOLD AND SILVER						
Boston-Mont. Corp.	N. Y. Curb	*19	*14	*14	.....	....
Cons. Virginia	San Francisco	18½	14⅛	14⅛	.....	....
Continental Mines	N. Y. Curb	5⅛	4⅞	5	.....	....
Dolores Esperanza	N. Y. Curb	1⅞	1 15/16	1⅞	Apr. '23	2.50
Tonopah Belmont	N. Y. Curb	1⅛	1 1/16	1⅛	Apr. '23, Q	0.05
Tonopah Divide	N. Y. Curb	*78	*65	*67	.....	....
Tonopah Extension	N. Y. Curb	3	2 15/16	2 15/16	Jan. '23, Q, X	0.10
Tonopah Mining	N. Y. Curb	1⅞	1 11/16	1⅞	Apr. '23, Q	0.7½
Unity Gold	N. Y. Curb	5⅛	4⅞	4⅞	.....	....
West End Consol.	N. Y. Curb	1 1/16	1	1 1/16	Mar. '23, Q	0.05
SILVER-LEAD						
Bingham Mines	Boston	18	17	18	Sept. 19, Q	0.25
Caledonia Mng.	N. Y. Curb	*7	7*	*7	Jan. '21, M	0.01
Cardiff M. & M.	Salt Lake	...	...	*30½	Dec. '20,	0.15
Chief Consol.	Boston Curb	4¼	4	4⅛	Feb. '23, Q	0.10
Columbus Rexall	Salt Lake	*43	*30	*43	Aug. '22,	0.03
Consol. M. & S.	Montreal	28¾	26½	27	Oct. '20, Q	0.62½
Federal M. & S.	New York	...	...	10½	Jan. '09,	1.50
Federal M. & S. pfd.	New York	54½	51	52	Mar '23, Q	1.75
Florence Silver	Spokane	*38⅝	*38	*38	Apr. '19, Q, X	0.01½
Hecla Mining	N. Y. Curb	9¼	9¼	9⅜	Mar. '23,	0.25
Iron Blossom Con.	N. Y. Curb	*32	*30	*32	Apr. '22, Q	0.02½
Marsh Mines	N. Y. Curb	*14	*13	*13	June '21, I	0.02
Park City	Salt Lake	3.50	3.30	3.30	Apr. '23,	0.12½
Park Utah	N. Y. Curb	...	...	3¼	Apr. '23	0.15
Prince Consol.	Salt Lake	*10½	*8¾	*9	Nov. '17,	0.02½
Silversmith	Spokane	*44½	*42	*43½	Apr. 23,	0.01
Simon Silver Lead	N. Y. Curb	*46	*41	*42	.....	....
Tamarack-Custer	Spokane	1.52	1.48	1.48	Jan. '21, K	0.04
Tintic Standard	Salt Lake	2.85	2.85	2.85	Dec. '22, Q, X	0.10
Utah-Apex	Boston	5⅛	5⅛	5⅛	Nov. '20, K	0.25
IRON						
Bethlehem Steel "B"	New York	66½	64	64⅝	Apr. '23, Q	1.25
Char. Iron	Detroit	...	...	2 1/16	.....	....
Char. Iron, pfd	Detroit	...	...	3¼	.....	....
Colorado Fuel & Iron	New York	30½	28	30	May '21	0.75
Col. Fuel & Iron, pfd.	New York	...	...	102	Feb. '23, Q	2.00
Gt. North'n Iron Ore	New York	32½	31½	31½	Dec. '22	1.00
Inland Steel	N. Y. Curb	46¼	45¼	46½	Mar. '23	0.25
Mesabi Iron	N. Y. Curb	10	9⅜	9⅜	.....	....
Replogle Steel	New York	27⅛	25¼	25⅜	.....	....
Republic I. & S.	New York	65	61	62	May '21	1.50
Republic I. S., pfd.	New York	96½	93¼	93⅞	Apr. '23	1.75
Sloss-Sheffield S. & I.	New York	58½	55	55	Feb. '21	1.50
Sloss-Shef. S.&I., pfd.	New York	86	84	84	Apr. '23	1.75
U. S. Steel	New York	107½	104⅜	105½	Mar. '23, Q	1.25
U. S. Steel, pfd.	New York	120	118⅜	105½	Feb. '23	1.75
Virginia I. C. & C.	New York	...	...	64	Jan. '22	1.50
Virginia I.C.&C., pfd.	New York	...	...	82	Jan '23	2.50
VANADIUM						
Vanadium Corp.	New York	40⅜	40	38½	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	69½	68	69½	Apr. '23 Q	1.50
Asbestos Corp. pfd.	Montreal	90	89½	90	Apr. '23 Q	1.75
SULPHUR						
Freeport Texas	New York	18⅛	17⅞	17⅞	Nov. '19, Q	1.00
Texas Gulf	New York	64⅜	61	62⅞	Mar. '23, Q	1.25
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3½	3	3½	.....	....
MINING, SMELTING AND REFINING						
Amer. Metal	New York	51⅛	49	49	Mar. '23, Q	0.75
Amer. Metal pfd.	New York	115½	114	114	Mar. '23, Q	1.75
Amer. Sm. & Ref.	New York	65⅜	62⅝	64½	Mar. '21, Q	1.00
Amer. Sm.& Ref. pfd	New York	100	99½	99½	Mar. '23 Q	1.75
U. S. Sm. R. & M.	New York	36	34	34	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	44½	44½	44½	Apr. '23 Q	0.87½

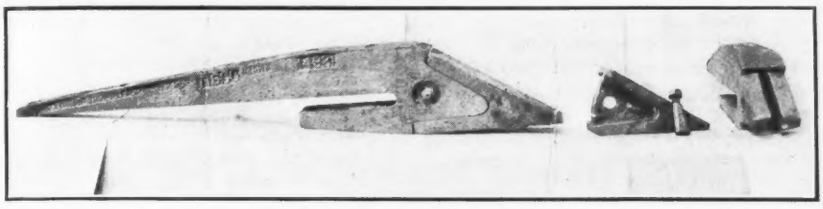
*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.

NEW MACHINERY AND INVENTIONS

New Dipper Tooth for Steam-Shovels

A new type of replaceable dipper tooth has been invented and perfected by the Taylor-Wharton Iron & Steel Co., of High Bridge, N. J. The tooth is known as the Van-Port reversible dipper tooth. It is made symmetrical with reference to the socket which receives the center web of the tooth. The sides of the tooth are beveled inward and seat upon bevels upon the socket. An inner rib fits into half ovals upon the socket. A bolt with a tapered head of oval section holds the tooth in place, the bolt hole in the web of the tooth being made oval to allow a slight adjustment. Nothing protrudes at the crown or sides of the tooth. The bolt locks in place. Both the base and tooth are made of manganese steel. L. W. Van Buskirk and Philip Porter, both of the Taylor-Wharton Iron & Steel Co., designed the tooth.



Reversible dipper tooth

S-A Monitor Car Puller

Various types of safety car pullers have been designed by Stephens-Adamson engineers to meet a wide range of requirements. Machines with vertical or horizontal capstans are built for general industrial service when loaded or empty cars are to be shifted on the track siding. The S-A Monitor car puller is the latest design of car pullers made by this company, and is now ready to be placed on the market. It is of the vertical capstan type, self-contained, and fully inclosed, and is a compact and powerful machine. It is driven by a 7½-hp. electric driving motor, and sufficient power is generated in the capstan to permit of pulling from three to five loaded cars on a level track.

The weight of the puller complete is 2,000-lb.; motor speed is 1,800 r.p.m.; capstan speed, 17 r.p.m.; rope speed, 40 ft. per minute; horsepower, 7½; and capacity rope pull, 5,000 lb. One of the features of this new machine is the ingenious and efficient arrangement of speed reduction. One man easily operates the machine, and there is no complicated mechanism, requiring an expert operator.

The S-A Monitor type car puller is offered as a most modern method of relegating the old antiquated "strong-arm" methods of moving cars to the scrap heap. Turn on the switch, snub the rope with several turns around the slow-moving capstan, and the machine does the work—no delay and no excessive switching charges. The operating expense, 7½ hp., is practically negligible, and the extreme simplicity in construction of this latest type of car puller makes for cheap and efficient operation. Complete details regarding this device can readily be obtained by addressing the manufacturers, the Stephens-Adamson Manufacturing Co., at Aurora, Ill.

Scoop Body for Quarry Work

Built particularly for use with the Ford truck, a self-dumping body developed by the Easton Car & Construction Co., 50 Church St., New York, has features which make it interesting for quarry work. The body is a complete unit which can be attached or detached in a few moments by means of four U-bolts. It is claimed that this body is especially adapted to hand loading, and the dumping and righting can be done by the driver without his leaving the seat. With its depressed lip, the scoop affords a low hand-loading height and this makes it adaptable to other uses than overhead bin loading. The body is gravity dumping in action, and in righting it is slammed back and locked automatically by a strong spring latch. The angle of dump may be adjusted for various conditions by shortening or lengthening the check chains.

New scoop body for quarries

INDUSTRIAL NOTES

How a Leather Belt Transmits Power

The manner in which a leather belt transmits power is discussed by J. Edgar Rhoads and R. R. Tatnall, both of J. E. Rhoads & Sons, in a paper, just published by the Leather Belting Exchange. According to the authors, the act of putting the belt on the pulleys under tension causes the belt to stretch. The stretch is partly elastic, and partly inelastic. The elastic part of the stretch gives the belt a tendency to contract again, thus causing grip or traction on the pulleys which is necessary for transmission of power, and causing also pull on the journals, which means journal-friction, with loss of power.

The inelastic part of the stretch is due to a slippage of the leather fibers on each other, and this slip is not recovered when the tension is removed. This means slight internal friction, and some slight loss of energy, which appears as heat in the belt.

Some of these forces considered seem to be a comparatively small proportion of the total forces acting on the belt, and yet under certain conditions, as in the case of centrifugal force at high speeds, they may exert a large effect upon the behavior of the belt.

Now start the belt running, but without load. The new features are: (1) Effect of stiffness of belt and (2) effect of centrifugal force.

The stiffness of a belt causes internal friction at all points where the belt bends or unbends. This generates heat and means some lost energy.

Centrifugal force acts on every particle of leather that is moving in a curved path, as around the pulleys or

in the sag. This causes centrifugal tension in the whole belt.

The amount of centrifugal tension depends on (*a*) weight per foot of the belt; doubling the weight per foot doubles the centrifugal tension. It also depends on (*b*) the speed of the belt, and is proportional to the square of the speed; doubling the speed multiplies the centrifugal tension four times.

At extreme speeds, the centrifugal tension may become equal to or greater than the original tension, in which case the belt may be seen to stand off from the pulleys, touching them only at the top where its weight is supported. Under these conditions little or no power can be transmitted.

Centrifugal effects tend to make the belt keep the same shape it would have at slow speeds; not to make it fly out into a circular shape, or follow around the pulley. This latter effect, where observed, is due to stiffness—never to centrifugal force. This can be proved in a physical laboratory by a well-known experiment with a chain, which is made to rotate at a high speed around a moving pulley, while the chain hangs loose below the pulley. That is, the chain is much longer than the circumference of the pulley. When a high speed is attained, the chain can be pushed sideways off the pulley and it will crawl along the floor, maintaining its same oval shape without forming a circle, though of course where it actually rests on the floor there is a slight flattening effect. As its energy is lost, it will of course collapse.

When a load is applied the important additional factors are (1) changes in length, (2) creep, (3) slip.

(1) When transmitting power, there must be a tight and a slack side. A given section of belt is stretched more on the tight side than on the slack side. Therefore this section is longer when passing onto the driving pulley than when passing off. The reverse is true at the driven pulley. The change in length must take place while on the pulleys and is called creep.

On account of the elasticity of leather, there is actually a different speed in the particles of belt traveling on the tight side from that which exists on the slack side. We have actually observed a difference of over 1 per cent between the speed of the slack and tight sides of the belt, near the point where the belt leaves the pulleys. It is hoped that more accurate means of measurement for a very careful study of this subject will be developed in the not distant future. The actual amount of creep observed in a belt running under very light load is very small and at light loads the particles are probably only slipping upon the surface of the two pulleys for a few degrees of the arc of contact on the pulley.

The region in which creep takes place probably begins at the point where the belt leaves the pulley, and extends backward as the load is increased, finally covering the entire arc of contact.

(3) At this point slip begins, that is, in addition to the creep, the belt as a whole begins to slip on the pulley all around the arc of contact. Speed of slip increases with increasing load, and when excessive, the belt may run off the pulley.

We have now considered the principal observed facts concerning a belt when at rest, and when running with and without load.

The two factors of power are (1) speed, and (2) pulley traction or grip.

1. More power can be transmitted by running the belt faster. Except for the centrifugal effect, the power would be proportional to the speed—twice the speed would give twice the power. But since the unfavorable effect of centrifugal action is proportional to the equare of the speed, this soon overbalances the other, and beyond a certain point, power begins to decrease as the speed increases.

As the centrifugal effect depends on the weight of the belt, it is advantageous to use the lightest stock and the thinnest and narrowest belt compatible with sufficient strength and reasonably long life.

2. The second factor of power is grip or traction. This is the same as the frictional force of the pulley on the belt, and is equal to the difference of tension between tight and slack sides. The friction does not depend on the width of the belt, but does involve:

a. Character of surface of belt—kind of leather, tanning, currying.

b. Pulley surface—iron, steel, wood, and paper.

c. Tension of belt, because this produces pressure of belt on pulley: the greater the pressure, the greater the traction.

d. Arc of contact: the friction increases rapidly with the arc of contact, so that a small increase in arc gives a large increase of friction.

e. The speed of creep and slip: friction between belt and pulley increases as the speed of slip or creep increases. In other words, the grip of the belt on the pulley is better when slipping, and the faster the slip the better the grip, up to a certain point. Evidently this must be true, else, after slip begins, more power could not be obtained—the belt would simply slip faster.

This property of leather belting, which gives an increase in its pulling power as the slip increases, is a most interesting and valuable characteristic, and one whose significance has been appreciated for only a short time. It is this property which gives to leather belting, which has been properly tanned and curried, its wonderful capacity for carrying enormous overloads above the normal rating of the belt. With the best belts this reaches a point well over 100 per cent of its normally rated capacity. In this connection, it is pointed out that within the last few years improved methods of tanning and currying, adopted by the most progressive manufacturers, have resulted in its being possible for a properly made leather belt to be rated for ordinary purposes at a materially higher figure than was generally considered safe a few years ago. These improvements, chiefly to the surface of the leather, have resulted in conservatively estimating the capacity of a given leather belt at about one-third more than was general five years ago.

In a preliminary way, it may be stated that the leather belt seems to show a more perfect elasticity than some, and probably than most or all, of the fabric belts. As a result, there is less actual waste of energy in the leather belt during the operation of the "creep" when it is carrying a load than in other types. As a properly prepared leather belt is more pliable than many of the fabric belts, there is less loss of energy in this respect also. From a power standpoint, however, the main saving obtained through the use of the best leather belt as compared with most fabric belts is that the leather belt can run with a larger proportion of the tension on the bearings doing effective work. There can be less tension upon the slack side of the belt, consequently less waste of energy through bearing-friction. On some drives this is a very large factor indeed, one which probably would of itself justify investment in the best type of leather belt at a much greater first cost, entirely disregarding the fact that the leather is usually a much long lived belt.

Conical ball mills have been purchased by the following companies: The Idaho Metals Co., Mackay, Idaho, a 4½-ft. diameter by 16-in. mill; the Tallassee Power Co., Badin, N. C., a 3-ft. diameter by 8-in. mill for experimental purposes; the M. D. Becerra Co. a 4½-ft. diameter by 16-in. mill to be shipped to Bogota, Colombia; the Golden Age Junior Mining Co., Pioneerville, Idaho, a 6-ft. diameter by 22-in. mill to grind in closed circuit with a classifier for cyanidation; and the Mazapil Copper Co., Ltd., Saltillo, Coahuila, Mexico, a 7-ft. diameter by 36-in. mill. After operating a 6-ft. ball mill for a year, the Mazapil company will use this larger mill in its flotation plant.

C. B. Andrews, manager of sales promotion and the research department of the Taylor-Wharton Iron & Steel Co., was recently in San Francisco and Los Angeles, on an inspection tour.

The Board of Water Commissioners of Denver, Colo., has placed an order with the Advance Machinery & Supply Co., Railroad Building, Denver, for one 4,000,000-gal. electrically driven De Laval centrifugal pumping unit; one 8,000,000-gal. electrically driven De Laval centrifugal pumping unit; and one 10,000,000-gal. De Laval steam-turbine-driven centrifugal pumping unit with condenser. This equipment will be furnished by the De Laval Steam Turbine Co., of Trenton, N. J., which the Advance company represents, and which specializes in the manufacture of high-efficiency pumping and prime-mover equipment.